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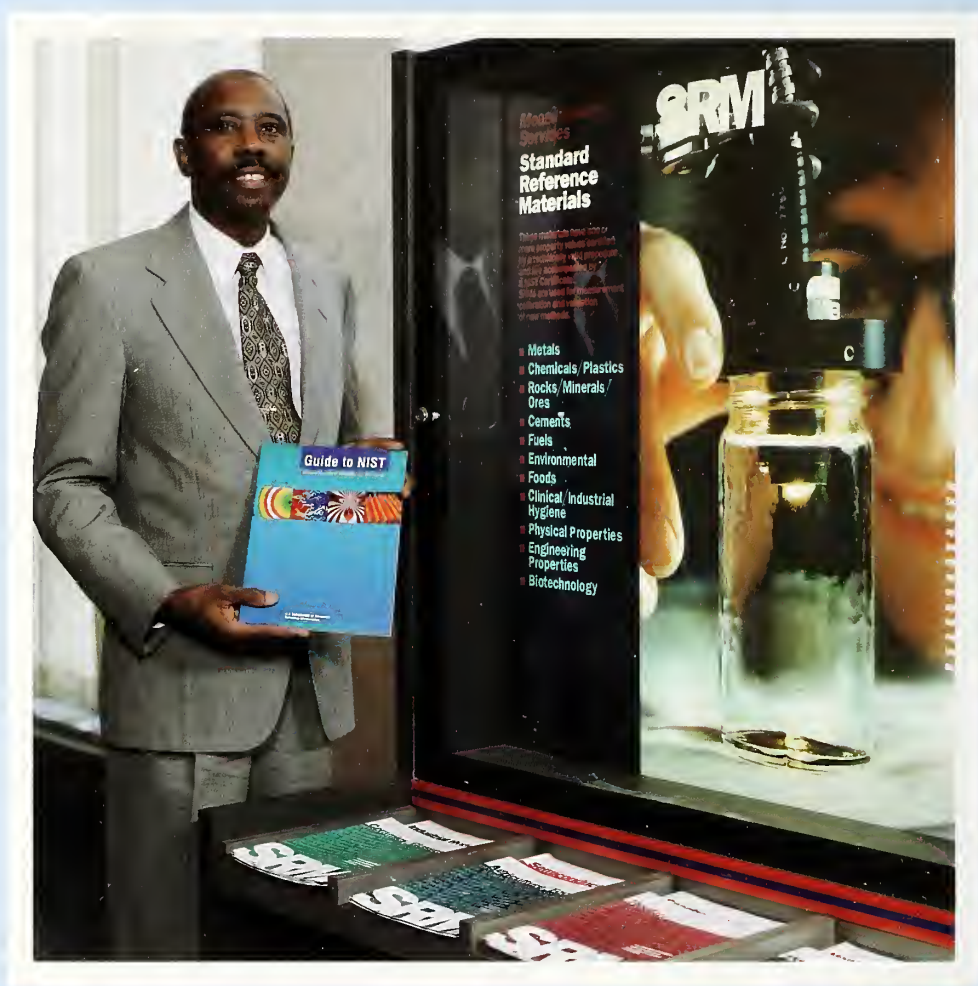
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SRM[®]

SO₂



Thomas E. Gills, *Chief*, Standard Reference Materials Program



Standard Reference Materials[®] Catalog 1995-96

NIST Special Publication 260

Nancy M. Trahey, Editor

Standard Reference Materials Program
National Institute of Standards and Technology
Gaithersburg, MD 20899-0001



U.S. DEPARTMENT OF COMMERCE

Ronald H. Brown, Secretary

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Mary L. Good, Under Secretary for Technology

National Institute of Standards and Technology

Arati Prabhakar, Director

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Fax: (301) 948-3730

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See page 8 for Instructions

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Foreword

The National Institute of Standards and Technology (NIST), formerly the National Bureau of Standards, was created by a Congressional act in 1901 to be the source and custodian of standards for physical measurement in the United States and charged with the responsibility for establishing a measurement foundation to facilitate both national and international commerce. This mission was purposely stated in broad terms in order to allow the agency the flexibility to reorient its programs in response to changing national needs and priorities. As a result of its congressionally mandated mission, first the National Bureau of Standards and now NIST has aimed its research and service activities toward:

helping U.S. industry improve its competitiveness through new technologies, modernized production processes, improved quality control and rapid commercialization.

At the same time, the Institute has two very important goals in serving the needs of its other major customers — government at all levels, academia, and the general public. They are:

improving public health, safety, and the environment through selected research programs, and conducting fundamental research that advances science and engineering.

The evolving linkage between the United States and world economy has resulted in an increased awareness of the need for comparability among data used to assess product quality and/or evaluate processes. Standard Reference Materials (SRMs) represent one mechanism by which measurement quality and traceability to national and international standards can be achieved when they are properly used. As a part of its congressional mandate the goals of NIST are to: develop reference and definitive methods of analysis, certify and issue standards, and assure their effective use in the measurement community, thereby helping to achieve accurate measurements in the United States and throughout the world.

The Standard Reference Materials Program distributes over 1300 different SRMs developed and certified in the NIST laboratories. NIST has a customer base for its standards of over 60,000 users with approximately 25% located outside the United States. All currently available SRMs are described in this Standard Reference Materials Catalog, Special Publication 260. In addition to the current stock of SRMs, the Program will partner with customers to evaluate proposed SRMs for their potential to meet industry-wide requirements, to develop SRMs based on identified needs, and issue new SRMs that will help standardization efforts.

As the world commerce and trade markets have become more global, customers are using SRMs more to achieve conformance to process requirements and measurement quality that address international as well as national needs for commerce and trade. All measurements using SRMs have the capability of being traceable to a common and recognized set of standards and consequently the compatibility of laboratories can be realized.

Continued support for the SRM Program is appreciated.

Thomas E. Gills, Chief
Standard Reference Materials Program
National Institute of Standards and Technology

Acknowledgments

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Contents

	Page
Abstract and Key Words	1
NIST Policies Regarding Use of Metric (SI) Units and On Measurement Uncertainty Statements	2
How to Use This Catalog	4
Program Information	
Definitions	6
SRM Catalog	7
Preparation and Availability of Standard Reference Materials	7
Guide for Requesting Development of Standard Reference Materials	7
Ordering Standard Reference Materials	
General	9
Out-of-Stock Materials	9
Terms and Conditions	9
Late Charges	10
Proforma Invoice (Price Quotation)	10
Domestic Shipments	10
Foreign Shipments (and shipments to Alaska and Hawaii)	10
Restricted Shipments – Dangerous Goods (Hazardous Materials)	10
Restricted Shipments – Temperature Sensitive Materials	11
Documentation	11
Rush Shipments	11
Returned Goods	12
SRM/RM Certificates and Material Safety Data Sheets	12
Other Services of the National Institute of Standards and Technology	
Calibration and Related Measurement Services	13
Standard Reference Data Program	13
Accreditation of Testing Laboratories	13
National Center for Standards and Certification Information	14
Weights and Measures Programs	14
Proficiency Sample Program	14
Guide to SRM/RM Technical Categories	19
SRMs/RMs by Category	25
Certified Reference Materials From Other Sources	
Special Nuclear Materials	108
NIST Special Publications in the 260 Series	133
SRM/RM Indexes	
Subject	139
Numerical and Certificate	156
Numerical Material Safety Data Sheet (MSDS)	165

Abstract and Key Words

This catalog provides technical and general ordering information for the Standard Reference Materials (SRMs) and Reference Materials (RMs) currently available from the National Institute of Standards and Technology (NIST) Standard Reference Materials Program (SRMP). The materials are arranged according to technical category and classified as follows: Standard Reference Materials for Chemical Composition; Standard Reference Materials for Physical Properties; and Standard Reference Materials for Engineering Materials. Technical descriptions are given for all materials and may include certified values. However, these values are incomplete as they appear in the catalog and therefore cannot be referenced for actual measurement purposes. The certificates issued by the SRMP are the only legitimate sources of certified information for NIST reference materials.

Key Words: analysis, calibration, Certified Reference Materials, characterization, composition, concentration, material, measurement, property, quality assurance, quality control, Reference Materials, Standard Reference Materials, standardization.

NIST Policy Regarding Use of Metric (SI) Units

The following policy was established in February 1991:

“In accordance with the Metric Conversion Act of 1975 as amended by Section 5164 of the Omnibus Trade and Competitiveness Act of 1988 and as required by related provisions of the Code of Federal Regulations, the National Institute of Standards and Technology (NIST) will use the modern metric system of measurement units (International System of Units – SI) in all publications. When the field of application or the special needs of users of NIST publications require the use of non-SI units, the values of quantities will be first stated in SI units and the corresponding values expressed in non-SI units will follow in parentheses.”

The technical information contained in this catalog is consistent with the above policy. Only SI units and symbols have been used to describe the reference materials contained herein. Therefore, abrogated or obsolete quantifiers (i.e., the term, ppm), no longer appear, but rather have been replaced with the correct SI term, (mg/kg), and reference material values previously expressed in only in-lb units, have been converted to the appropriate SI units [1,2]. Due to space limitations, the non-SI units converted are not shown in the catalog.

There is one notable exception to this policy – use of the quantifier, “Wt. %”. While this quantifier is not a SI unit, it is very widely used in industry and thus appears in many SRM certificates and throughout this catalog. However, in accordance with the above policy, future SRM certifications which heretofore would have been expressed in “Wt. %”, will instead be expressed as a fraction or a percent of the appropriate SI unit which pertains to the quantity(ies) certified.

Note to SRM Users: *Individual SRM certificates should be consulted to ascertain if certification data have been expressed in both SI and non-SI units.*

[1] The International System of Units (SI), NIST Special Publication 811, 1994 Edition.

[2] ASTM E380-93 Standard Practice for Use of the International System of Units (SI) (the Modernized Metric System), ASTM, 1916 Race Street, Philadelphia, PA 19103.

NIST Policy On Measurement Uncertainty Statements

The following policy was established in January 1993:

“[].....All NIST measurement results are to be accompanied by quantitative statements of uncertainty [1]. To ensure that such statements are consistent with each other and with present international practice, this NIST policy adopts in substance the approach to expressing measurement uncertainty recommended by the International Committee for Weights and Measures (CIPM).”

[The CIPM approach is based on Recommendation INC-1 (1980) of the Working Group on the Statements of Uncertainties. More recently, at the request of the CIPM, a joint BIPM/IEC/ISO/OIML working group developed a comprehensive reference document on the general application of the CIPM approach [2]. The development of this document is providing further impetus to the worldwide adoption of the CIPM approach.]

The uncertainty statements contained in certificates for SRMs produced after January 1993, are in compliance with the above policy. To the fullest extent possible, these certificates describe the uncertainty components associated with each certified value reported, in terms recommended by the CIPM approach. The NIST technical division(s) that approved the certification protocol, produced the SRM, and evaluated the certified value(s) and associated uncertainty(ies) resulting therein, are responsible for employing the statistical methods that are in accordance with this policy.

Note to SRM Users: *It is essential that all statistical information contained in a NIST SRM certificate be carefully reviewed before the certified value(s) and associated uncertainty(ies) are applied to a measurement process or program.*

[1] Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results NIST Technical Note 1297, 1994 Edition.

[2] ISO Guide to the Expression of Uncertainty of Measurement: 1993 (E); ISO Technical Advisory Group on Metrology, Working Group 3, First Edition 1993.

How to Use This Catalog

The *NIST Standard Reference Materials Catalog 1995–96* lists Standard Reference Materials (SRMs) and Reference Materials (RMs) issued by the NIST Standard Reference Materials Program. It consists of a guide and three (3) indexes, each of which groups the SRMs and RMs according to a distinctive characteristic or descriptor. Selection of the guide or one index over another to locate the information desired will depend on the user's prior knowledge of a specific SRM or RM and intended SRM or RM application.

Guide to SRM/RM Technical Categories – This is a general listing based on the three major categories into which all the SRMs and RMs have been assigned. The *categories* are divided into sequentially numbered sections, each of which describes a material class or technical property class. The *sections* are further divided into subsections, each of which describes a specific type of material or technical property and the physical form(s) of the SRMs and RMs contained therein. The titles of the *subsections* are the descriptors for the tables comprising the catalog.

EXAMPLE

Category	-	Standard Reference Materials for CHEMICAL COMPOSITION, 25 through 91 (page nos.)
Section	-	102. Nonferrous Metals, 36 through 47 (page no.)
Subsection (Descriptor)	-	Zinc Base Alloys (chip and disk forms), 46 (page no.)

SRM/RM Subject Index – This index is based on short word descriptors (one to four words) of the SRMs and RMs in the catalog. These descriptors may identify a section, subsection, a material class, a specific SRM property, a specific SRM application, or a measurement technique. Some descriptors may coincidentally also identify an individual SRM or RM; however, only a few SRMs or RMs will be so described. The index is arranged in *alphabetical order of the first word of the descriptor*. Because of the variety of descriptors used, some SRM and RM materials may be cross-referenced.

EXAMPLE

Index Entry	-	ALLOYS (NONFERROUS)
Descriptor (s)	-	See NONFERROUS METALS, 39 through 47 (page nos.)
Index Entry	-	ZINC
Descriptor	-	Spelter (ZINC BASE ALLOYS), 46 (page no.)

SRM/RM Numerical and Certificate Index – This index is based on the unique numerical identifier assigned to each and every SRM and RM issued by NIST. This identifier is the *SRM or RM Number*, an integral part of the reference material name which appears on each SRM certificate or RM report of investigation. The index lists all the SRMs and RMs sequentially by this number, beginning with SRM 1c and ending with RM 9529. A short word descriptor of the SRM or RM, the category subsection in which it is assigned, and the *certificate or report-of-investigation date of issue* are also provided for reference.

EXAMPLE

SRM – 94c
Descriptor – Zn Base Die Casting Alloy
Certificate Date – Dec 94
Section Code – 102
Page – 46 (page no.)

SRM/RM Material Safety Data Sheet (MSDS) Index – The index is similar to the Numerical and Certificate Index but it lists *only* those SRMs/RMs for which *Material Safety Data Sheets (MSDSs)* are required. The identifier is the *SRM or RM Number* and the short word descriptor used in the Numerical Index. These are followed by the *MSDS Number*, which usually carries the same SRM/RM number identifier, *and its date of issue*. In accordance with applicable national and international regulations, a copy of the MSDS accompanies every shipment of its relevant SRM/RM.

EXAMPLE

SRM – 1450b
Descriptor – Thermal Resistance Board
MSDS Number – 1450b
MSDS Date – Apr 92
Page – 166

HOW TO LOCATE SPECIFIC INFORMATION

About an unknown SRM or RM material needed for a particular technical application –

Refer to the **Guide to SRM/RM Technical Categories**, select the most appropriate of the three categories, review all the sections and subsections therein and note the page numbers.

About a material from a specific class of materials and of known technical application –

Refer to the **SRM/RM Subject Index**, check for alternative descriptors and cross-references, and note page numbers.

About a material whose SRM or RM number is known –

Refer to the **SRM/RM Numerical and Certificate Index** and note the page number.

Whether or not a SRM or RM has (or requires) a Material Safety Data Sheet –

Refer to the **SRM/RM Material Safety Data Sheet Index**.

Program Information

The National Institute of Standards and Technology (NIST) offers for sale over 1,300 different materials through its Standard Reference Materials Program. These materials are primarily Standard Reference Materials (SRMs) certified for their chemical compositions, chemical properties, or physical properties, but also include other reference materials. All materials bear distinguishing names and numbers by which they are permanently identified. Thus, each material bearing a given description is identical (within the specified limits) to every other sample bearing the same designation—with the exception of individually certified items, which are further identified by serial number.

Definitions

From “Terms and definitions used in connection with reference materials,” ISO Guide 30-1992 (E):

1. “Reference Material (RM): A material or substance, one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.”
2. “Certified Reference Material (CRM): A reference material, one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body.”

NIST Standard Reference Materials (SRMs): Certified reference materials issued by NIST. These are well-characterized materials produced in quantity to improve measurement science. SRMs are certified for specific chemical or physical properties, and are issued by NIST with certificates that report the results of the characterization and indicate the intended use of the material. They are prepared and used for three main purposes:

- (1) To help develop accurate methods of analysis (reference methods);
- (2) To calibrate measurement systems used to:
 - (a) facilitate exchange of goods,
 - (b) institute quality control,
 - (c) determine performance characteristics, or
 - (d) measure a property at the state-of-the-art limit; and
- (3) To assure the long-term adequacy and integrity of measurement quality assurance programs.

NIST certified values are obtained by one or more of the following measurement routes:

- (1) A previously validated reference method,
- (2) Two or more independent, reliable measurement methods, or
- (3) A network of cooperating laboratories, technically competent and thoroughly knowledgeable with the material being tested.

An in-depth discussion of the use of SRMs can be found in NIST Special Publication 260-100 “Standard Reference Materials HANDBOOK FOR SRM USERS” written by John K. Taylor (February 1993, edited by N. M. Trahey).

A number of Reference Materials (RMs) listed in this catalog are sold, but not certified, by NIST. However, they meet the ISO definition for RMs, and many meet the definition for CRMs. The documentation issued with these materials is either a:

- (1) “Report of Investigation,” the sole authority being the author of the report. RMs are intended to further scientific or technical research on particular materials. The principal consideration in issuing RMs is to provide a homogeneous material so that investigators in different laboratories are assured that they are investigating the same material.
- (2) “Certificate,” issued by the certifying agency (other than NIST), e.g., other national laboratories, other government agencies, other standardizing bodies, or other non-profit organizations. When deemed to be in the public interest and when alternate means of national distribution do not exist, NIST acts as the distributor for such materials. This service is available to organizations that qualify and have the reference materials that would help meet national measurement needs.

SRM Catalog

New catalogs of NIST SRMs (and RMs) are published approximately every 2 years, listing materials available and renewal materials in preparation, and deleting discontinued materials. The Catalog is supplemented by Price Lists issued simultaneously with each new catalog and annually to keep the catalog current between editions. These supplements list current prices, and reflect any changes in material availability—listing new and renewal materials and deleting discontinued ones.

A guide and three indexes are provided for user convenience. They are described in the section, **How to Use This Catalog**.

Preparation and Availability of SRMs

New and renewal SRMs are being prepared continually. While these SRMs are included in the next edition of the catalog and its supplements, prospective users whose names are on the SRM mailing list are also notified as soon as the new items become available. Requests for placement on the SRM mailing list can be submitted at any time to the Standard Reference Materials Program.

Renewal SRMs are intended to be completed before the supply of an existing SRM is exhausted. However, this is not always possible and an SRM may be out of stock for a time. When this occurs, those ordering the material are so notified and possible substitute SRMs are suggested. When a renewal is issued, customers who have ordered the previous lot are promptly notified of the price and availability of the renewal. If little demand exists or if an alternate source of supply becomes available, production of an SRM may be discontinued permanently.

Renewal SRMs may not be identical to the preceding lot; however, they meet the same specifications and can be used for the same purpose. For example, the first 0.1% carbon Bessemer steel was prepared in 1909 (Standard Sample No. 8). Since then a number of renewals, 8a, 8b, 8c, etc., have been prepared. The current SRM 8j 0.1C, represents the eleventh lot of the material. Each lot differs somewhat in detailed analysis; thus the use of the specific certificate for that lot is essential.

Guide for Requesting Development of SRMs

NIST has the responsibility to develop, produce, and distribute SRMs that provide a basis for comparison of measurements on materials, and that aid in the control of production processes. To carry out this function, the Standard Reference Materials Program evaluates the requirements of science, industry, and government for well-characterized reference materials, and directs the production and distribution of such materials.

To become a SRM, a candidate material must meet one or more of these criteria:

1. It would permit users to attain more accurate measurements.
2. Its production elsewhere would not be economically or technically feasible.
3. It would be an industry-wide standard for commerce from a neutral source not otherwise available to the public.
4. Its production by NIST would assure continued availability of a well-characterized material important to science, industry, or government.

NIST has recognized and responded to requests to enlarge the scope of the Standard Reference Materials Program to include all types of well-characterized materials for use in calibrating measurement systems, or for producing scientific data that can be referred to a common base. However, the requests for new SRMs greatly exceed NIST's capacity to produce and certify such materials. Consequently, requests for new SRMs of limited need or use are deferred in favor of requests that clearly show a critical need. To determine which requests receive priority, NIST seeks and uses information supplied by industry and such organizations as the American Petroleum Institute (API), American Society for Testing and Materials (ASTM), etc., to objectively assess the urgency and importance of proposed new reference materials.

Requests to the Standard Reference Materials Program for the development of a new SRM should provide the following information:

1. Short title of the proposed SRM.
2. Purpose for which the SRM would be used.
3. Reasons why the SRM is needed.
4. Technical characteristics and requirements for the material. Include additional requirements and reasons if more than one SRM is necessary for standardization in this area.
5. Estimates of the probable present and future (5–10 years) demand for such an SRM, nationally and internationally.
6. Justification for SRM preparation by NIST, particularly if a similar one could be produced or obtained from another source.
7. Pertinent information to aid justification for the SRM, such as: (a) an estimate of the potential range of application, monetary significance of the measurement affected, scientific and technological significance including, when feasible, estimates of the impact upon industrial productivity, growth, quality assurance or control, and (b) supporting letters from industry leaders, trade organizations, interested standards committees, and others.

All such requests should be addressed to:

National Institute of Standards and Technology
Standard Reference Materials Program
Room 112, Building 202
Gaithersburg, MD 20899-0001
ATTN: SRM Development

Ordering NIST Reference Materials

General

Purchase orders (in English) for all NIST SRMs/RMs should be directed to:

National Institute of Standards and Technology
Standard Reference Materials Program
Room 204, Building 202
Gaithersburg, MD 20899-0001
USA

Telephone: (301) 975-6776
Fax: (301) 948-3730
E-Mail: SRMINFO@enh.nist.gov

Each purchase order should give the number of units, catalog number, and name of each reference material requested.

Example: 1 each, SRM 79a, Fluorspar (Customs Grade).

The following information must be included with each order: a billing address, a shipping address, name of customer, telephone number, fax number, purchase order number, a customer identification number, i.e., a social security number (SSN) for consumer customers, tax identification number (TIN) for commercial customers, or agency code (ALC) for U.S. government customers.

Note: NIST SRMs/RMs are only distributed in the units of issue listed in this catalog and its supplement (price list). Also, purchase orders or inquiries submitted in a language other than English, will take several weeks to process.

Acceptance of an order does not imply acceptance of any provisions set forth in the order that are contrary to the policy, practice, or regulations of the National Institute of Standards and Technology or the United States Government.

Out-of-Stock Materials

Orders for “out-of-stock” SRMs/RMs, are generally filled with the renewal reference materials — if available; otherwise the orders will be canceled. Customers are notified when an order is canceled and their names are placed on a notification list. This list is used to contact customers when the reference material (or its renewal) is again available. Upon notification, customers are told the price of the material and are asked to submit a new order if they still wish to purchase it.

For some SRMs/RMs, production lots are small and stock outages occur frequently. In these cases, the notification list is used to fill orders on a “*first come, first served*” basis. Customers are contacted when the reference materials are again available and are asked to confirm their original purchase orders.

Terms and Conditions

Prices quoted for SRMs/RMs are in U.S. dollars (\$), and are published in the catalog supplement (price list). The prices shown therein are subject to change without notice and orders will be invoiced for the prices in effect at the time of shipment. Shipping and handling charges for regular and special (for SRMs in restricted categories) shipments, are also applied to all orders. These charges will be added to the invoices.

Note: A 10% discount is given on individual purchase orders for 50 or more SRM units (single SRM, or combination of SRMs).

Payment of all invoices is expected within 30 days of receipt for domestic orders – 45 days of receipt for foreign orders, and may be made by any of the following:

- Banker's draft against U.S.A. bank,
- Bank to bank transfer to U.S.A. bank,
- Cash against documents,
- VISA or Mastercard only,
- International money order.

Late Charges

In accordance with U.S. Treasury regulations, late charges will be levied for each 30/45-day period, or portion thereof, that an invoice payment is overdue.

Proforma Invoice (Price Quotation)

Proforma invoice service requires 3 to 4 weeks to process and is furnished *only* to those customers requiring such service.

Domestic Shipments

SRM/RM shipments within the continental U.S. are shipped F.O.B. Gaithersburg, MD. There are several shipping modes which can be used, including UPS Ground, Federal Express, Roadway Package Service, Air Freight, and Motor Freight (Collect). Unless otherwise instructed by the customer, the mode of shipment will be selected by NIST. Fewer shipping modes are available to SRMs/RMs in restricted categories and NIST reserves the exclusive right to select the proper shipping mode for these types of shipments. For restricted SRM/RM shipments, an additional charge is incurred for each shipping container used. This charge is added to the invoice.

Foreign Shipments (and shipments to Alaska and Hawaii)

SRM/RM shipments outside the contiguous U.S. are also shipped F.O.B. Gaithersburg, MD by one of the following modes, including UPS International, Federal Express International (subject to size, weight, and category of material limitations), Air Parcel Post, and Air Freight. Unless otherwise instructed by the customer, the mode of shipment will be selected by NIST. Any other mode of shipment requested by the customer must be paid by the customer. Fewer shipping modes are available to SRMs/RMs in restricted categories and NIST reserves the exclusive right to select the proper shipping mode for these types of shipments.

Restricted Shipments – Dangerous Goods (Hazardous Materials)

Some SRMs/RMs are classified as "Dangerous Goods" by the U.S. Department of Transportation (DOT), the International Civil Aviation Organization (ICAO), or the International Air Transport Association (IATA). These organizations have published regulations and procedures for packaging and shipping dangerous (hazardous) goods which must be followed to safely transport these materials. Such regulations and procedures are very specific and do not allow exceptions. NIST reserves the exclusive right to select the proper packaging and shipping mode to assure the shipments comply with these regulations and procedures.

Restricted Shipments — Temperature Sensitive Materials

Some SRMs are extremely temperature-sensitive and will perish unless shipped by the most expedient mode available. To ensure the stability of these materials, they must be packaged with Cool Packs or dry ice which will maintain the necessary low temperatures for a short period of time. However, *several SRMs are so temperature-sensitive that they are restricted to domestic sales only*, and must be shipped according to a set schedule.

Documentation (All documents are printed in English)

The documentation NIST furnishes are:

- a. Commercial invoice(s),
- b. Packing slip(s),
- c. Air waybill for air shipments (provided UPON REQUEST ONLY),
- d. NAFTA Certificate(s) (when applicable),
- e. SRM/RM Certificate(s) — one (1) for each unit ordered,
- f. Material Safety Data Sheet(s) — one (1) for each type or ordered material requiring it.

CUSTOMERS ARE REQUIRED TO INSPECT ALL PACKAGES AND DOCUMENTATION IMMEDIATELY UPON RECEIPT OF SHIPMENT. ANY DAMAGE, SHORTAGES OR DEFECTS MUST BE REPORTED TO SRM PROGRAM CUSTOMER RELATIONS AT (301) 975-6776, WITHIN FIVE (5) DAYS OF RECEIPT OF SHIPMENT.

Rush Shipments

Requests for rush shipments will be accommodated when possible. However, they will be made in compliance with existing regulations pertaining to the SRMs/RMs being shipped and when hazardous materials are involved, all regulations governing their transportation will take precedence. The following types of rush shipments are available:

- Same day shipping — Orders must be placed by **10:00 AM Eastern Standard Time (EST)**. In addition to the normal shipping fees, a processing fee of \$50.00 will be added to the customer's invoice.
- Next day shipping — In addition to the normal shipping fees, a processing fee of \$25.00 will be added to the customer's invoice.

(Exception: Hazardous materials will not be shipped the same day.)

Returned Goods

NIST SRMs/RMs are generally not returnable — with the exception of defective goods or shipments made in error by NIST. However, normal transaction of business inevitably requires the occasional return of merchandise for exchange or credit. NIST has therefore instituted the following returned goods policy:

- Return shipments are accepted by NIST only **after** specific arrangements to do so have been made. To return a SRM/RM, SRM Program Customer Relations must be contacted to obtain a *Return Authorization Number and shipping instructions*. REQUESTS FOR RETURN AUTHORIZATION MUST BE MADE WITHIN THIRTY (30) DAYS OF RECEIPT OF SHIPMENT.
- Return shipments of hazardous SRMs/RMs authorized by SRM Program Customer Relations, must be packed, marked, labeled, and shipped in accordance with national and international regulations governing their transportation. Opened, leaking or damaged hazardous SRM/RM units and/or their containers **CANNOT BE RETURNED TO NIST** but should be disposed of in accordance with applicable laws and regulations.

Returns which will not be authorized or accepted **UNDER ANY CIRCUMSTANCES** include:

- **Perishable SRM/RMs,**
- **Unsealed, partially used, modified or mutilated SRMs/RMs,**

SRM/RM Certificates and Material Safety Data Sheets

Each SRM/RM shipment contains sufficient copies of Certificates and MSDSs (if applicable) for the number of units ordered. However, if these documents are misplaced, NIST will provide additional copies free of charge upon request and when proof of purchase has been provided. Customers may call, fax, or use the following e-mail addresses to send in their requests:

for Certificates — SRMCERT@enh.nist.gov
for MSDSs — SRMMSDS@enh.nist.gov

Requests will usually be processed within twenty-four (24) hours. Documents under or equalling ten (10) pages will be faxed; documents exceeding ten (10) pages will be mailed. If the documentation is urgently needed, the customer must provide a Federal Express account number.

NIST also provides copies of misplaced 'Archive certificates' free of charge to customers who possess NIST SRMs/RMs that are no longer for sale. This service is available on a one-time-only basis.

Other Services of the National Institute of Standards and Technology

Calibration and Related Measurement Services

The measurement services of NIST include calibrations, special tests, and Measurement Assurance Programs (MAPs). The calibrations and MAPs of NIST satisfy the most demanding and explicit measurement requirements, in that these services are carried out regularly under pre-established and well-defined conditions; the measurement processes involved are well-characterized, stable and in a state of statistical control; and quality control procedures are well-defined and strictly followed. These services are described in NIST Special Publication 250, *Calibration Services Users Guide*. For more information on available calibration services, or how to obtain a copy of Special Publication 250, inquiries should be directed to:

Calibrations Program
National Institute of Standards and Technology
Room A104, Building 411
Gaithersburg, MD 20899-0001

Telephone: (301) 975-2002
Fax: (301) 926-2884
E-Mail: CALIBRATIONS@enh.nist.gov

Standard Reference Data Program

The Standard Reference Data (SRD) Program provides well-documented numeric data to scientists and engineers for use in technical problem-solving, research, and development. These recommended values are based on data which have been extracted from the world's literature, assessed for reliability, and then evaluated to select the preferred values. The primary vehicles for dissemination of this data are the *NIST Standard Reference Database Series* and the *Journal of Physical and Chemical Reference Data (JPCRD)*. Databases and publications are described in SP 782 – NIST Standard Reference Data Products Catalog. To obtain a copy, please contact the following:

Standard Reference Data Program
National Institute of Standards and Technology
Room A320, Building 221
Gaithersburg, MD 20899-0001

Telephone: (301) 975-2208
Fax: (301) 926-0416
E-Mail: SRDATA@enh.nist.gov

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Donna Clarke, *Computer Programmer Analyst*



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Pam Ritger, *Student Trainee*; **Carmen Davis**, *SRM Assistant, Hazardous Documentation Preparation*; **Michelle Brown**, *SRM Assistant, Records Management*



Robert Gettings, *Project Manager, Physical Properties*;
Jennifer Colbert, *Project Manager, Organic Materials*



Jean Kane, *Project Manager, Inorganic Materials*; **Paul Lundberg**, *Project Manager, Ferrous and Nonferrous Metals*

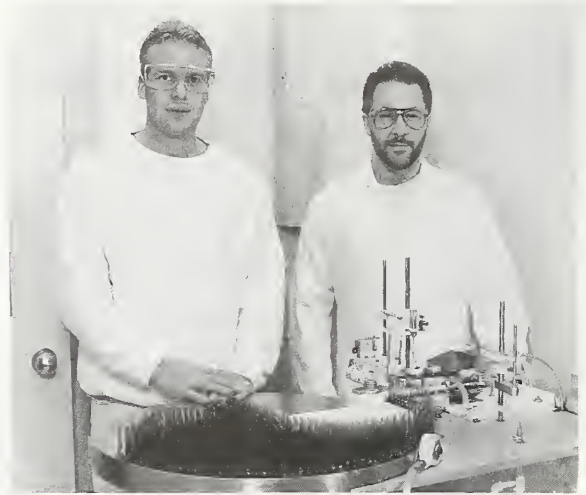


Bruce MacDonald, *Project Manager, Inorganic Materials*;
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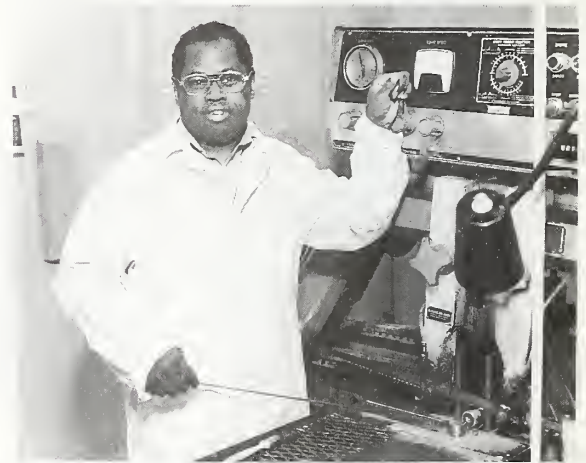
Gary Proulx, Physical Science Technician



Mark Cronise, Curt Fales, Physical Science Technicians



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John Savoy, Physical Science Technician



Jim Fort, Patty Fitzwater, Tom Shuggars, Physical Science Technicians, Shipping

Guide to SRM/RM Technical Categories

Standard Reference Materials for CHEMICAL COMPOSITION

101. Ferrous Metals, 25–38

Plain Carbon Steels (chip form), 25
Low Alloy Steels (chip form), 26
Special Low Alloy Steels (chip form), 27
High Alloy Steels (chip form), 28
Gases in Metals (rod form), 28
Stainless Steels (chip form), 29
Tool Steels (chip form), 29
Low Alloy Steels (disk and rod forms), 30
Low Alloy Steels (disk and rod forms) – Continued, 31
Low Alloy Steels (disk and rod forms) – Continued, 32
Low Alloy Steels (disk and rod forms) – Continued, 33
Stainless Steels (disk form), 34
Specialty Steels (disk form), 34
High Temperature Alloys (disk form), 35
Steelmaking Alloys (powder form), 36
Cast Irons (chip form), 37
Cast Steels, White Cast Irons and Ductile Irons (disk form), 38

102. Nonferrous Metals, 39–47

Aluminum Base Alloys (chip and disk forms), 39
Cobalt Base Alloys (chip and disk forms), 39
Copper Base Alloys (chip and rod forms), 40
Copper Base Alloys (block and disk forms), 41
Copper “Benchmark” (chip and rod forms), 42
Lead Base Alloys (chip and disk forms), 43
Lead Base Material (disk form), 43
Naval Brass (disk form), 43
Tin Base Alloys (chip form), 44
Nickel Base Alloys (chip and disk forms), 44
Trace Elements in Nickel Base Superalloys (chip form), 44
Nickel Oxides (powder form), 45
Titanium Base Alloys (chip and disk forms), 45
Zinc Base Alloys (chip and disk forms), 46
Zirconium Base Alloys (chip and disk forms), 46
Gases in Metals (platelet form), 46

103. Microanalysis, 47

Metals (rod and wire forms), 47
Synthetic Glasses (rod form), 47
Thin Film for Transmission Electron Microscope, 47

104. High-Purity Materials, 48–55

High-Purity Metals (solid forms), 48
Stoichiometry (powder form), 49
Microchemistry (powder form), 49
Spectrometry, Single Element (solution form), 50
Spectrometry, Single Element (solution form) – Continued, 51
Spectrometry, Multi-Element (solution form), 51
Spectrometry, Multi-Element (solution form) – Continued, 52
Chromium Speciation, 53
Anion Chromatography (solution form), 53
Stable Isotopic Materials (solid forms), 53
Royal Canadian Mint Reference Materials (solid forms), 54–55
Light Stable Isotopic Materials (gas, liquid and solid forms), 55

105. Health and Industrial Hygiene, 56–60

Clinical Laboratory Materials (gas and solid forms), 56
Serum Materials, 57
Ethanol Solutions, 57
Toxic Substances in Urine (powder form), 57
Drugs of Abuse, Single Analyte (powder form), 58
Drugs of Abuse, Multi-Analyte (powder form), 58
Drugs of Abuse in Hair (solid forms), 58
DNA Profiling (solid forms), 59
Materials on Filter Media, 59
Trace Constituent Element in Blank Filters, 59
Respirable Silica (powder form), 60
Lead in Paint (powder and sheet forms), 60
Asbestos, 60

106. Inorganics, 61–62

Metal Constituents (liquid and solid forms), 61
Simulated Rainwaters (liquid form), 61
Thin Films for X-ray Fluorescence, 61
Carbon Modified Silicon (powder form), 62
Trace Elements (liquid and solid forms), 62
Used Auto Catalysts (powder form), 62

107. Analyzed Gases, 63–65

Mixtures and Pollutants, 63
Mixtures and Pollutants – Continued, 64
Mixtures and Pollutants – Continued, 65
Permeation Devices, 65

108. Fossil Fuels, 66–68

Alcohols and Ethers [Oxygenates] in Reference Fuels (liquid form), 66

Metal Constituents in Fossil Fuels (liquid and solid forms), 66
Sulfur in Fossil Fuels (liquid and solid forms), 67
Moisture in Oils (liquid form), 67
Reference Liquids for Evaluating Fuels, 67
Trace Elements (solid form), 68

109. Organics, 69–74

GC/MS and LC System Performance (liquid form), 69
Organic Constituents (liquid and solid forms), 69
Organic Constituents (liquid and solid forms) – Continued, 70
Organic Constituents (liquid and solid forms) – Continued, 71
Organic Constituents (liquid and solid forms) – Continued, 72
Organic Constituents (liquid and solid forms) – Continued, 73
Organic Constituents (liquid and solid forms) – Continued, 74

110. Food and Agriculture, 75–78

Foods and Beverages (liquid and powder forms), 75
Health Care and Nutrients (liquid and solid forms), 76
USA/Canada Collaborative Materials (powder form), 76
Agricultural Materials (powder form), 77
Fertilizers (powder form), 78
Biomass Materials (powder form), 78

111. Geological Materials and Ores, 79–84

Chinese Ores (powder form), 79
Ores (powder form), 79
Ores (powder form) – Continued, 80
Ores (powder form) – Continued, 81
Ore Bioleaching Substrate (powder form), 81
Clays (powder form), 82
Rocks and Minerals (powder form), 83
Refractories (powder form), 83
Soils and Sediments (powder form), 84

112. Ceramics and Glasses, 85–87

Carbides (powder form), 85
Cemented Carbides (powder form), 85
Glasses (powder and solid forms), 86
Trace Elements (powder and wafer forms), 87

113. Cement, 88–89

Portland Cements (powder form), 88
Portland Cement Clinkers (solid form), 89

114. Engine Wear Materials, 90–91

Metallo-organic Compounds (liquid form), 90
Lubricating Base Oils (liquid form), 90
Catalyst Characterization Materials (liquid and powder forms), 90
Catalyst Package for Lubricant Oxidation (liquid form), 91
Wear-metals in Oil (liquid form), 91

Standard Reference Materials for PHYSICAL PROPERTIES

201. Ion Activity, 95–96

pH Calibration (powder form), 95
Biological Buffer Systems (powder form), 95
pD Calibration (powder form), 95
Ion-Selective Electrode Calibration (powder form), 96
Electrolytic Conductivity (liquid form), 96

202. Polymeric Properties, 97–98

Molecular Weight and Melt Flow (pellet and powder forms), 97
Polyethylene Pipe Products, 98
Rubbers and Rubber Compounding Materials (powder and solid forms), 98

203. Thermodynamic Properties, 99–103

Combustion Calorimetry (powder form), 99
Solution Calorimetry, 99
Enthalpy and Heat Capacity (solid forms), 99
Differential Scanning Calorimetry (solid forms), 100
Differential Thermal Analysis (liquid and solid forms), 100
Superconductive Thermometric Fixed Point Device, 100
Defining Fixed Point, International Temperature Scale, ITS-90 (solid forms), 101
Secondary Reference Points (solid forms), 101
Melting Point and Triple Point (liquid and powder forms), 101
Laboratory Thermometer (mercury in glass), 102
Thermocouple Material, Platinum (wire form), 102
Vapor Pressure of Metals (rod and wire forms), 102
Thermal Conductivity of Graphite and Metals (rod form), 103
Thermal Expansion of Glass and Silica (rod form), 103
Thermal Resistance of Glass and Silica (solid forms), 103

204. Optical Properties, 104–107

Molecular Absorption and Molecular Luminescence Spectrometry (film, filter, solid, and solution forms), 104–106
Specular Spectral Reflectance (plate form), 107
Infrared Reflectance (solid form), 107
Directional Hemispherical Reflectance (wafer form), 107
Refractive Index – See 209. *Miscellaneous Properties*
Optical Rotation (powder form), 107
Photography (chart form), 107

205. Radioactivity, 108–113

Radiation Dosimetry (wire form), 108
Fission Track Glass (wafer form), 108
Special Nuclear Materials, 108
Radioactive Solutions, 109

Radiopharmaceuticals (solution and gaseous forms), 110
Alpha Particle Point Sources, 111
Carbon-14 Dating (solid form), 111
Accelerator Mass Spectrometry (solution form), 111
Low Energy Photon Point Source, 111
Gamma Ray Point Sources, 112
Radon Emanation (encapsulated solution form), 112
Natural Matrix Materials (powder form), 113

206. Electrical Properties, 114–115

Electrical Resistivity and Conductivity of Metals
(rod form), 114
Electrical Resistivity and Conductivity of Silicon
(block and wafer forms), 114
Residual Resistivity Ratio (rod form), 115
Superconducting Critical Current (wire form), 115

207. Metrology, 116–118

Scanning Electron Microscope (SEM), 116
Optical Microscope Linewidth Measurement
(wafer form), 116
Depth Profiling (wafer form), 116
Optical Fiber Geometry (solid form), 116
Copper and Chromium Coating on Steel
(plate form), 117
Solder Thickness (plate form), 117
Gold Coating on Fe-Ni-Co Alloy (plate form), 117
Ellipsometry (wafer form), 118
Oxygen Concentration in Silicon (wafer form), 118
NIST Time Software, 118

208. Ceramics and Glasses, 119–120

Chemical Resistance (Durability) of Glass
(solid form), 119
Electrical Properties of Glass (bar form), 119
Viscosity of Glass (bar form), 119
Viscosity Fixpoints (solid forms), 120
Relative Stress Optical Coefficient (bar form), 120
Glass Liquidus Temperature (solid form), 120

209. Miscellaneous Properties, 121–122

X-ray Diffraction (powder and solid forms), 121
X-ray Diffraction of Ferrous Materials (disk and
wafer forms), 121
X-ray Stage Calibration (solid forms), 121
Density and Refractive Index (liquid and solid forms), 122
Bleached Kraft Pulps (sheet form), 122

Standard Reference Materials

for

ENGINEERING MATERIALS

301. Sizing, 125–126

Particle Size (powder and solid forms), 125
Cement Turbidimetry and Fineness (powder form), 125
Electrophoretic Mobility, μ_E (suspension form), 126
Surface Area of Powders, 126

302. Surface Finish, 127

Microhardness (block form), 127
Abrasive Wear (block form), 127
Corrosion (plate form), 127
Surface Roughness (block form), 127

303. Nondestructive Evaluation, 128

Dye Penetrant Test Blocks, 128
Artificial Flaw for Eddy Current NDE, 128
Magnet Particle Inspection, 128

304. Automatic Data Processing, 129

Magnetic Computer Storage Media, 129

305. Fire Research, 130

Surface Flammability (sheet form), 130
Smoke Density Chamber (sheet form), 130
Smoke Toxicity (granulated and sheet forms), 130
Flooring Radiant Panel (sheet form), 130

309. Miscellaneous Performance

Engineering Materials, 131

Charpy V-Notch Test Blocks, 131
Socketed Ball Bar, 131
Coordinate Measuring Machine (CMM)
Probe Performance, 131
Tape Adhesion Testing (sheet form), 131

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SRMs/RMs (by Technical Category)

Standard Reference Materials for Chemical Composition

101. Ferrous Metals

Plain Carbon Steels (chip form)

These SRMs are for checking chemical methods of analysis. They consist of steel alloys selected to provide a wide range of analytical values for elements. They are furnished in 150-g units (unless otherwise noted) as chips usually sized between 0.4 mm to 1.2 mm, prepared from selected portions of commercial ingots.

SRM	Type	Elemental Composition (in Wt. %)				
		C	Mn	P	S	Si
8j	0.1C	0.081	0.505	0.095	0.077	0.058
11h	0.2C	0.200	0.510	0.010	0.026	0.211
12h	0.4C	0.407	0.842	0.018	0.027	0.235
13g	0.6C	0.613	0.853	0.006	0.031	0.355
14g	AISI 1078	0.735	0.456	0.006	0.019	0.232
15h	0.1C	0.076	0.373	0.005	0.019	0.008
16f	1.1C	0.97	0.404	0.014	0.026	0.214
19h	0.2C	0.215	0.393	0.016	0.022	0.211
20g	AISI 1045	0.462	0.665	0.012	0.028	0.305
152a	0.5C (Tin bearing)	0.486	0.717	0.012	0.030	0.202
178	0.4C	0.395	0.824	0.012	0.014	0.163
337a	1.1C (Carbon & Sulfur) (300 g)	0.969			0.024	
368	AISI 1211	0.089	0.82	0.084	0.132	0.007

SRM	Cu	Ni	Cr	V	Mo	Co	Ti	Sn	Al (total)	N
8j	0.020	0.113	0.047	0.015	0.038					
11h	0.061	0.028	0.025	0.001			0.004			
12h	0.073	0.032	0.074	0.003	0.006				(0.038)	0.006
13g	0.066	0.061	0.050	0.001					0.048	
14g	0.047	0.030	0.081	0.0008	0.011				0.025	
15h	0.013	0.017	0.018	<0.001	0.009				0.061	
16f	0.006	0.008	0.020	0.002	0.003	0.003				
19h	0.466	0.248	0.173	0.003	0.038				0.002	
20g	0.034	0.034	0.036	0.002	0.008				0.040	
152a	0.023	0.056	0.046	0.001	0.036			0.032		
178	0.032	0.010	0.016	0.001	0.003					
368	0.010	0.008	0.030	0.001	0.003					0.010

Values in parentheses are not certified and are given for information only.

NOTE: SRM 21e, 0.5 C, in In Prep.

101. Low Alloy Steels (chip form)

SRM	Type	Elemental Composition (in Wt. %)						
		C	Mn	P	S	Si	Cu	
					Grav	Comb		
30f	Cr-V (SAE 6150)	0.490	0.79	0.011		0.009	0.283	0.074
32e	Ni-Cr (SAE 3140)	0.409	0.798	0.008	0.022	0.021	0.278	0.127
33e	Ni-Mo (SAE 4820)	0.186	0.525	0.005		0.009	0.262	0.070
36b	Cr-Mo	0.114	0.404	0.007		0.019	0.258	0.179
72g	AISI 4130	0.278	0.492	0.009		0.014	0.223	0.011
100b	Manganese (SAE 340)	0.397	1.89	0.023	0.029	0.028	0.210	0.064
106b	Cr-Mo-Al (Nitalloy G)	0.326	0.506	0.008	0.016	0.017	0.274	0.117
125b	High Silicon	0.028	0.278	0.029		0.008	2.89	0.071
129c	High Sulfur (SAE 112)	0.125	0.769	0.076		0.245	0.020	0.013
131e	High Silicon	0.0035				0.0004		
139b	Cr-Ni-Mo (AISI 8640)	0.403	0.778	0.013		0.019	0.242	0.097
155	Cr-W	0.905	1.24	0.015	0.010	0.011	0.322	0.083
163	Cr (100 g)	0.933	0.897	0.007		0.027	0.488	0.087
179	High Silicon	0.027	0.094	0.006		0.026	3.19	0.056
291	Cr-Mo (ASTM A213)	0.177	0.550	0.008		0.020	0.230	0.047
293	Cr-Ni-Mo (AISI 8620)	0.222	0.960	0.018		0.022	0.300	0.032
2171	Ni-Cr-Cu-Mo (HSLA 100)	0.066	0.73	0.006		0.0012	0.338	1.47

SRM	Ni	Cr	V	Mo	Sn	Al (total)	N
30f	0.070	0.945	0.182				0.010
32e	1.19	0.678	0.002	0.023	(0.011)		0.009
33e	3.36	0.068	(0.001)	0.224	(0.002)	0.030	
36b	0.203	2.18	0.004	0.996			
72g	0.016	0.905	0.003	0.170		(0.041)	(0.008)
100b	0.030	0.063	0.003	0.237			0.004
106b	0.217	1.18	0.003	0.199		1.07	
125b	0.038	0.019		0.008	0.003	0.329	Ca 0.0051
129c	0.251	0.014	0.012	0.002			
139b	0.510	0.488	0.004	0.182			0.007
155	0.100	0.485	0.014	0.039			W 0.517
163	0.081	0.982		0.029			0.007
179	0.050	0.022	<0.01	0.014	0.004	0.0028	
291	0.065	1.33		0.538		0.002	
293	0.480	0.510	0.004	0.204		0.039	
2171	3.35	0.550	0.003	0.546		0.019	Nb 0.024

Values in parentheses are not certified and are given for information only.

101. Special Low Alloy Steels (chip and pin forms)

SRM	Type	Elemental Composition (in Wt. %)							
		C	Mn	P	S	Si	Cu	Ni	Cr
361	AISI 4340	0.383	0.66	0.014	0.0143	0.222	0.042	2.00	0.694
362	AISI 94B17 (mod.)	0.160	1.04	0.041	0.0360	0.39	0.50	0.59	0.30
363	Cr-V (mod.)	0.62	1.50	0.029	0.0068	0.74	0.10	0.30	1.31
364	High Carbon (mod.)	0.87	0.255	0.01	0.0250	0.065	0.249	0.144	0.063
2159	Carbon & Sulfur only (pin)	0.016			0.0023				
2160	Carbon & Sulfur only (pin)	0.584			0.012				
2165	E	0.0059	0.144	0.0052	0.0038	(0.004)	0.0013	0.155	0.050
2166	F	0.015	0.066	0.0012	0.0023	0.010	0.015	0.022	0.024
2167	G	0.051	0.022	0.0031	0.0091	0.026	0.0014	0.002	0.0015
2168	High-Purity Iron	0.0007	0.0006	0.0015	0.0010	(<5.0)*	0.0005	0.0012	0.0003

SRM	V	Mo	W	Co	Ti	As	Sn	Al (total)	Nb	Ta	Zr	N	Ca
361	0.011	0.19	0.017	0.032	0.020	0.017	0.010	0.021	0.022	0.020	0.009	(0.0037)	0.00010
362	0.040	0.068	0.20	0.30	0.097	0.092	0.016	0.083	0.29	0.20	0.19	(0.00404)	0.00021
363	0.31	0.028	0.046	0.048	0.050	0.010	0.104	0.24	0.049	(0.053)	0.049	(0.0041)	0.00022
364	0.105	0.49	0.10	0.15	0.24	0.052	0.008	(0.008)	0.157	0.11	0.068	(0.0032)	0.00003
2165	0.0040	0.0055		0.0012	0.0051	0.0010	0.002	(0.006)	0.0004	(0.004)			
2166	0.009	0.0035		0.0022	0.0007	0.0035	0.0010	0.012	0.005	(0.011)	(0.0004)		
2167	0.033	0.020		0.0050	0.010	0.0005	0.006	0.0045	0.0095	(0.002)	(0.004)		
2168	(<1.0)*	(<7.0)*	(<7.0)*	0.0006	(<3.0)*	(<1.0)*	(<1.0)*	(<5.0)*	(<5.0)*	(<1.0)*	(<5.0)*	0.0007	(<2.0)*

SRM	B	Pb	Sb	Bi	Ag	Se	Te	Ce	La	Nd	Fe
361	0.00037	0.000025	0.0042	(0.0004)	0.0004	(0.004)	(0.0006)	0.0040	(0.001)	0.00075	(95.6)
362	0.0025	0.00048	0.013	(0.002)	0.0011	(0.0012)	(0.0005)	0.0019	(0.001)	0.00075	(95.3)
363	0.00078	0.00186	0.002	(0.0008)	0.0037	(0.00016)	(0.0009)	0.0030	(0.002)	0.0012	(94.4)
364	0.0106	0.0230	0.034	(0.009)	(0.00002)	(0.00021)	(0.0002)	0.00057	(0.0002)	0.00018	(96.7)
2165	(0.0009)	0.0003	0.0010	(<0.0001)	0.0002	(0.0035)	(0.003)				
2166	(0.0004)	0.003	0.0005	(<0.0001)	0.0005	(0.0035)	(0.003)				
2167	(0.001)	(<0.0001)	0.0020	(<0.0001)	0.0007		(0.0003)				
2168	(<1.0)*	(<1.0)*	(<3.0)*	(<3.0)*		(<2.0)*	(<1.0)*				

SRM	Mg	Zn	Pr	Ge	O	H	Au	Hf	Sr
361	0.00026	(0.0001)	(0.0003)	[0.006]	(0.0009)	(<0.0005)	(<0.00005)	(0.0002)	(<0.0005)
362	0.00068	(0.00012)	(0.0003)	[0.002]	(0.00107)	(<0.0005)	(<0.00005)	(0.0003)	(<0.0005)
363	0.00062	(0.0004)	(0.0004)	[0.010]	(0.00066)	(<0.0005)	0.0005	(0.0005)	(<0.0005)
364	0.00016	[0.001]	(0.0001)	[0.003]	(0.0010)	(<0.0005)	0.0001	(0.0013)	(0.001)
2165	<0.0001								
2166	<0.0001								
2167	<0.0001								
2168	<5.0)*	<5.0)*			0.010	Cd (<1.0)*			

Values in parentheses are not certified and are given for information only.

Values in brackets are approximate values from heat analysis and are given for information only.

*Value is in mg/kg (SI unit).

101. High Alloy Steels (chip form)

SRM	Type	Elemental Composition (in Wt. %)					
		C	Mn	P	S	Si	Cu
					Comb		
126c	High Nickel (36% Ni)	0.025	0.468	0.004	0.005	0.194	0.040
344	Cr-Ni (Mo Precipitation Hardening)	0.069	0.57	0.018	0.019	0.395	0.106
345a	Cr-Ni (Cu Precipitation Hardening)	0.040	0.79	0.024	0.012	0.61	3.39
346a	Valve Steel	0.502	9.16	0.031	0.002	0.219	0.375
348a	High Temperature Alloy (A286) Ni-Cr	0.044	0.64	0.023	0.0007	0.43	0.14
862	High Temperature Alloy L605	0.120	1.59	0.002	0.0008	0.017	0.0010
868	High Temperature Alloy Fe-Ni-Co	0.022	0.052	<0.003	0.0025	0.097	0.022

SRM	Ni	Cr	V	Mo	Co	Ti	Al (total)	Nb	Ta	B	Fe
126c	36.05	0.062	0.001	0.011	0.008						
344	7.28	14.95	0.040	2.40		0.076	1.16				
345a	4.27	15.52	0.080	0.43	0.099	(<0.01)	(<0.01)	0.27	(<0.01)	(<0.001)	N 0.031
346a	3.43	21.08	0.096	0.237	(0.05)	(<0.001)	(0.001)	(0.01)	Sn (0.008)	(<0.001)	N 0.442
348a	24.2	14.8	0.23	1.18	0.15	2.12	0.24	(0.07)	W (0.07)	0.0055	(55.2)
862	9.74	20.0	0.005	N 0.026	51.5	W 15.1	(<0.01)	(<0.005)	(<0.01)	(<0.0001)	1.80
868	37.78	0.077	0.077	0.014	16.1	1.48	0.99	2.99	0.003	0.0078	40.5

Values in parentheses are not certified and are given for information only.

101. Gases in Metals (rod form)

These SRMs are for determining hydrogen, oxygen, and nitrogen by vacuum fusion, inert gas fusion, and neutron activation methods.

SRM	Type	Oxygen (in mg/kg*)	Hydrogen (in mg/kg*)	Nitrogen (in mg/kg*)
1090	Ingot Iron	491		(60)
1091a	Stainless Steel (AISI 431)	132.2		(876)
1093	Valve Steel	60		
1094	Maraging Steel	4.5		(71)
**1095	Steel (AISI 4340)	9	(<5)	(37)
**1096	Steel (AISI 94B17)	10.7	(<5)	40.4
**1097	Cr-V Steel (mod.)	6.6	(<5)	(<11)
**1098	Steel (High Carbon)	10	(<5)	32
**1099	Electrolytic Iron	61	(<5)	(13)
1754	Low Alloy Steel (AISI 4320)	24		81

Values in parentheses are not certified and are given for information only.

*SI unit. Replaces terms "ppm" and "μg/g".

**These SRMs are sold only as a set designated SRM 1089.

101. Stainless Steels (chip form)

SRM	Type	Elemental Composition (in Wt. %)					
		C	Mn	P	S	Si	Cu
73c	Cr (SAE 420)	0.310	0.330	0.018	0.036	0.181	0.080
101g	AISI 304 L (100 g)	0.0136	0.085	0.007	0.0078	1.08	0.029
121d	Cr-Ni-Ti (AISI 321)	0.067	1.80	0.019	0.013	0.54	0.121
123c	Cr-Ni-Nb (AISI 348)	0.056	1.75	0.024	0.014	0.59	0.103
133b	Cr-Mo	0.128	1.07	0.018	0.328	0.327	0.080
160b	Cr-Ni-Mo (AISI 316)	0.044	1.64	0.020	0.016	0.509	0.172
166c	Carbon Only (100 g)	0.0078					
339	Cr-Ni-Se (SAE 303Se)	0.052	0.738	0.129	0.013	0.654	0.199
343a	Cr-Ni (AISI 431)	0.149	0.42	0.026	0.001	0.545	0.162
367	Cr-Ni (AISI 446)	0.093	0.315	0.018	0.016	0.58	
893	Cr (SAE 405)	0.027	0.378	0.022	0.0003	0.326	0.261
895	Cr-Mn (SAE 201)	0.066	7.09	0.038	0.0033	0.399	0.439

SRM	Ni	Cr	V	Mo	Co	Ti	Nb	Ta	Pb	Se	N
73c	0.246	12.82	0.030	0.091							0.037
101g	10.00	18.46	0.041	0.004	0.09						
121d	11.17	17.43		0.165	0.10	0.342					
123c	11.34	17.40		0.22	0.12		0.65	<0.001			
133b	0.230	12.63	0.071	0.052							
160b	12.26	18.45	0.047	2.38	0.101				0.001		0.039
339	8.89	17.42	0.058	0.248	0.096					0.247	
343a	2.16	15.64	0.056	0.164	(0.04)	(<0.001)	(0.01)	Al (0.001)	(<0.0001)	B (<0.001)	0.078
367	0.29	24.19	0.08								0.168
893	0.192	13.55	0.080	0.023	0.020	(0.01)	(<0.0005)	(<0.001)	(0.0001)	(<0.0001)	Al (0.20)
895	5.34	16.72	0.079	0.337	0.126	(<0.0004)	(<0.009)	(<0.001)	(0.0001)	(<0.0001)	W (0.03)

Values in parentheses are not certified and are given for information only.

101. Tool Steels (chip form)

SRM	Type	Elemental Composition (in Wt. %)					
		C	Mn	P	S	Si	Cu
50c	W-Cr-V	0.719	0.342	0.022	Grav 0.010	Comb 0.009	0.311
132b	Tool Steel (AISI M2)	0.864	0.341	0.012		0.004	0.185
134a	Mo-W-Cr-V	0.808	0.218	0.018	0.007	0.007	0.323

SRM	Ni	Cr	V	Mo	W	Co	Sn	As	N
50c	0.069	4.13	1.16	0.082	18.44		0.018	0.022	0.012
132b	0.230	4.38	1.83	4.90	6.28	0.029			
134a	0.088	3.67	1.25	8.35	2.00				

NOTE: SRM 2172, Tool Steel, is In Prep.

Steel SRMs described in this and the following three (3) pages are furnished in various forms. The 600 series is for microchemical methods of analysis, such as electron probe microanalysis and laser probe analysis. The 1100, 1200, and 1700 series are for optical emission and X-ray spectrometric methods of analysis. These materials have been prepared to ensure high homogeneity.

Nominal Sizes for Solid Steel SRMs:

600 Series: 3.2 mm diameter, 51 mm long.

1100 and 1200 Series: 31 mm diameter, 19 mm thick.

1700 Series: 34 mm diameter, 19 mm thick.

A "C" preceding the SRM number indicates a chill cast sample; 31 mm diameter, 19 mm thick.

101. Low Alloy Steels (disk and rod forms)

SRM	Type	Elemental Composition (in Wt. %)				
		C	Mn	P	S	Si
661	AISI 4340	0.392	0.66	0.015	0.015	0.223
663	Cr-V (mod.)	0.57	1.50	0.029	0.0055	0.74
664	High Carbon (mod.)	0.871	0.258	0.010	0.025	0.066
665	Electrolytic Iron	0.008	0.0057	0.0025	0.0059	0.0080
1134	High Silicon	0.026	0.277	0.028	0.009	2.89
1135	High Silicon	0.027	0.094	0.006	0.026	3.19
1218	High Silicon, Low Carbon & Sulfur	0.0029	0.014	(0.002)	0.0011	(3.2)
C1221	Resulfurized/Rephosphorized AISI 1211 (mod.)	0.020	0.102	0.090	0.112	0.876
1222	Cr-Ni-Mo (AISI 8640)	0.43	0.78	0.013	0.022	0.24
1224	Carbon (AISI 1078)	0.75	0.41	0.009	0.039	0.173
1225	Low Alloy (AISI 4130)	0.274	0.48	0.007	0.014	0.221
1226	Low Alloy	0.085	0.274	0.0022	0.0044	0.231
1227	Basic Open Hearth, 1% C	0.97	0.402	0.014	0.026	0.215
1228	0.1% C	0.072	0.365	0.004	0.018	0.007
1254	Low Alloy (Calcium only)	Ca 0.0053				
1261a	AISI 4340	0.391	0.67	0.016	0.015	0.228
1262b	AISI 94B17	0.160	1.05	0.044	0.037	0.40
1263a	Cr-V (mod.)	0.57	1.50	0.029	0.0055	0.74
1264a	High Carbon (mod.)	0.871	0.258	0.010	0.025	0.066
1265a	Electrolytic Iron	0.008	0.0057	0.0025	0.0059	0.0080
1269	Line Pipe (AISI 1526 mod.)	0.298	1.35	0.012	0.0061	0.189
1270	Cr-Mo Low Alloy, A336 (F-22)	0.077	0.626	0.0065	0.0065	0.247
1271	Ni-Cr-Cu-Mo (HSLA 100)	0.064	0.73	0.005	0.0013	0.334
C1285	Low Alloy (A242 mod.)	0.058	0.332	0.072	0.020	0.36
1286	Low Alloy (HY 80)	0.196	0.152	0.008	0.017	0.130
1761	Low Alloy Steel	1.03	0.678	0.040	0.035	0.18
1762	Low Alloy Steel	0.337	2.00	0.034	0.030	0.35
1763	Low Alloy Steel	0.203	1.58	0.012	0.023	0.63
1764	Low Alloy Steel	0.592	1.21	0.020	0.012	0.057
1765	Low Alloy Steel	0.006	0.144	0.0052	0.0038	(0.004)
1766	Low Alloy Steel	0.015	0.067	0.002	0.0024	0.010
1767	Low Alloy Steel	0.052	0.022	0.0031	0.0090	0.026
1768	High-Purity Iron	0.0010	0.0014	0.0013	0.0003	(<10.0)*

Values in parentheses are not certified and are given for information only.

*Value is in mg/kg (SI unit).

NOTE: SRM 1217a, Nickel Steel, is In Prep.

101. Low Alloy Steels (disk and rod forms) – Continued

SRM	Cu	Ni	Cr	V	Mo	W	Co	Ti
661	0.042	1.99	0.69	0.011	0.19	0.017	0.032	0.020
663	0.098	0.32	1.31	0.31	0.30	0.046	0.048	0.050
664	0.250	0.142	0.066	0.106	0.49	0.102	0.15	0.23
665	0.0058	0.041	0.007	0.0006	0.005	(< 0.0001)	0.007	0.0006
1134	0.070	0.038	0.019		0.008			
1135	0.056	0.050	0.022	< 0.01	0.014			
1218	0.003	(0.002)	0.006	(< 0.001)	(0.003)		(0.002)	(0.004)
C1221	0.041	0.067	0.049	(0.0007)	0.038		(0.010)	(0.0014)
1222	0.097	0.51	0.48	0.005	0.18		(0.016)	(0.002)
1224	0.072	0.054	0.071	0.002	0.013			
1225		0.018	0.91	0.004	0.166			
1226	0.125	5.42	0.467	0.0018	0.446	(0.005)	0.029	0.0021
1227	0.006	0.007	0.019	0.002	0.003	0.003	(0.0008)	
1228	0.012	0.018	0.016	< 0.001	0.009			
1261a	0.042	2.00	0.693	0.011	0.19	0.017	0.032	0.020
1262b	0.51	0.59	0.30	0.041	0.070	0.20	0.57	0.100
1263a	0.098	0.32	1.31	0.31	0.030	0.046	0.048	0.050
1264a	0.250	0.142	0.066	0.106	0.49	0.102	0.15	0.24
1265a	0.0058	0.041	0.0072	0.0006	0.0050	< 1	0.0070	(0.0001)
1269	0.095	0.108	0.201	0.004	0.036	(0.001)	(0.014)	(0.009)
1270	0.114	0.174	2.34	0.013	0.956	(0.003)	0.038	(0.003)
1271	1.48	3.34	0.552	0.003	0.543			
C1285	0.37	1.17	0.80	0.150	0.164	(0.03)	0.036	Ce (0.0021)
1286	0.043	2.81	1.53	0.0057	0.334	(0.13)	0.116	0.040
1761	0.30	1.99	0.220	0.053	0.103	(0.02)	(0.028)	0.18
1762	0.120	1.15	0.92	0.200	0.35	(0.01)	0.062	0.095
1763	0.43	0.51	0.50	0.30	0.50	(0.03)	0.095	0.31
1764	0.51	0.202	1.48	0.106	0.200	(< 0.01)	(0.01)	0.028
1765	0.0013	0.154	0.051	0.0040	0.005		0.0012	0.0055
1766	0.015	0.021	0.024	0.009	0.0035	(0.001)	0.0020	0.0005
1767	0.0014	0.002	0.0015	0.033	0.020		0.0050	0.011
1768	0.0006	0.0014	(< 2.0)*	(< 1.0)*	(< 3.0)*	(< 2.0)*	0.0025	(< 10.0)*

Values in parentheses are not certified and are given for information only.

*Value is in mg/kg (SI unit).

101. Low Alloy Steels (disk and rod forms) – Continued

SRM	As	Sn	Al (total)	B	Pb	Ag	Ge
661	0.017	0.011	0.021	0.0005	0.000025	0.0004	[0.006]
663	0.010	(0.095)	0.024	0.0009	0.0022	(0.0038)	[0.010]
664	0.052	[0.005]	(0.008)	0.011	0.024	(0.00002)	[0.003]
665	(0.0002)	(< 0.0005)	(0.0007)	0.00013	0.000015	(< 0.00002)	(< 0.0050)
1134		0.003	0.329				
1135		0.004	0.0028				
1218			0.005				
C1221			0.111				
1222			(0.038)				
1224			0.060				
1226		(0.003)	0.054		(0.0001)		
1227			(0.028)				
1228			0.061				
1261a	0.017	0.010	0.021	0.0005	0.000025	0.0004	[0.006]
1262b	0.096	0.016	0.081	0.0025	0.0004	0.0011	[0.002]
1263a	0.010	0.104	0.24	0.00091	0.0022	0.0037	[0.010]
1264a	0.052	(0.008)	(0.0080)	(0.011)	0.024	(0.000002)	[0.003]
1265a	(0.0002)	< 2	(0.0007)	0.00013	0.000015	< 0.2	< 50
1269	(0.006)	(0.039)	0.016	(< 0.0001)	0.005	(0.0002)	
1270	(0.02)	(0.02)	(0.005)	(0.0033)	(0.0016)	(0.0001)	
1271			0.020				
C1285	(0.022)	0.35	(0.12)				
1286	0.019	0.012	0.109	(0.006)	(0.0002)		
1761	0.011	(0.05)	0.06	0.0020			
1762	0.018	0.046	0.069	0.0049			
1763	0.055	0.011	0.043	0.0054			
1764	0.010	(0.02)	0.009	0.0010			
1765	0.0010	0.002	(0.006)	0.0009	0.0003	0.0002	
1766	0.0035	0.0010	0.012	0.00012	0.003	0.0005	
1767	0.0005	0.006	0.004	0.0010	(0.0001)	0.0008	
1768	(< 1.0)*	(< 1.0)*	0.0024	(< 2.0)*	(< 1.0)*		
SRM	O	N	H	Nb	Se	Ta	Zr
661	(0.0009)	(0.0037)	[< 0.0005]	0.022	0.004	0.020	0.009
663	(0.0007)	(0.0041)	[< 0.0005]	0.049	[0.0001]	(0.053)	0.050
664	[0.0017]	[0.003]	[< 0.0005]	0.157	[0.0003]	0.11	0.069
665	(< 0.0070)	(< 0.0020)	(< 0.0005)				
1218							(0.002)
C1221							(0.0017)
1222		(0.007)		(0.002)			(0.001)
1226				(0.005)			(0.010)
1227							(0.0006)
1261a	(0.0009)	(0.0037)	(< 0.0005)	0.022	0.004	0.021	0.009
1262b	(0.0011)	(0.0040)	(< 0.0005)	0.30	(0.0012)	0.20	0.22
1263a	(0.00066)	(0.0041)	(< 0.0005)	0.049	(0.00016)	(0.053)	0.050
1264a	(0.0010)	(0.0032)	(< 0.0005)	0.157	(0.00021)	0.11	0.69
1265a	< 70	< 20	< 5				
1271				0.025			
C1285							(0.02)
1286				(0.012)			(0.021)
1761		0.0044		0.02		0.05	0.01
1762		0.0022		0.07		0.02	0.03
1763		0.0044		0.10		0.01	0.04
1764		0.0023		0.042		0.029	0.0015
1765		0.0010		0.0004	(0.0035)	(0.004)	(0.0002)
1766		0.0033		0.005	(0.0035)	(0.006)	(0.0004)
1767		0.0008		0.010		(0.002)	(0.004)
1768	0.036	0.002	Cd (< 1.0)*	(< 5.0)*	(< 1.0)*	(< 1.0)*	(< 1.0)*

Values in parentheses are not certified and are given for information only.

Values in brackets are approximate values from heat analysis and are given for information only.

*Value is in mg/kg (SI unit).

101. Low Alloy Steels (disk and rod forms) – Continued

SRM	Sb	Bi	Ca	Mg	Te	Zn	
661	0.0042	0.0004	(<0.0001)	(0.0001)	0.0006	(0.0001)	
663	0.002	(0.0008)	(<0.0001)	(0.0005)	(0.0022)	(0.0004)	
664	(0.035)	(0.0009)	(<0.0001)	(0.0001)	[0.0002]	[0.001]	
665	(<0.00005)	(<0.00001)	(<0.00001)	(<0.00002)	(<0.00001)	(<0.0003)	
1261a	0.0042	0.0004	0.00002	0.00018	0.0006	(0.0001)	
1262b	0.012	(0.002)	(0.0001)	0.0006	(0.001)	(0.0005)	
1263a	0.002	(0.0008)	0.00013	0.00049	0.0009	(0.0004)	
1264a	0.034	(0.0009)	0.00004	0.00015	0.00018	[0.001]	
1265a						<3	
1254			0.0053				
C1285	(0.04)						
1765	0.0010	(<0.0001)		(<0.0001)	(0.003)		
1766	0.0005	(<0.0001)		(<0.0005)	(0.003)		
1767		(<0.0001)	(0.0003)	(<0.0001)	(0.0003)		
1768	(<1.0)*	(<4.0)*	(<1.0)*	(<6.0)*	(<1.0)*	(<1.0)*	
SRM	Au	Ce	Hf	La	Nd	Pr	Fe
661	(<0.0005)	0.013	[0.00002]	0.0004	0.0003	(0.00014)	(95.6)
663	0.0005	(0.0016)	[0.0015]	0.0006	(0.0007)	(0.00018)	(94.4)
664	0.0001	(0.00025)	[0.005]	0.00007	(0.00012)	(0.00003)	(96.7)
665							99.9
1261a	(<0.00005)	0.0014	(0.0002)	0.0004	0.00029	(0.00014)	(95.6)
1262b	(0.00005)	0.0019	(0.0003)	(0.0004)	0.0006	(0.00012)	(95.3)
1263a	0.0005	0.0014	(0.0005)	0.0006	0.00060	(0.00018)	(94.4)
1264a	0.0001	0.00022	(0.0013)	0.00007	0.00007	(0.00003)	(96.7)
1265a							99.9
1764							(95.2)
1766		(0.002)					

Values in parentheses are not certified and are given for information only.

Values in brackets are approximate values from heat analysis and are given for information only.

*Value is in mg/kg (SI unit).

101. Stainless Steels (disk form)

SRM	Type	Elemental Composition (in Wt. %)							
		C	Mn	P	S	Si	Cu	Ni	Cr
C1151a	23Cr-7Ni	0.034	2.39	0.017	0.038	0.29	0.385	7.25	22.59
C1152a	18Cr-11Ni	0.142	0.95	0.023	0.0064	0.64	0.097	10.86	17.76
C1153a	17Cr-9Ni	0.225	0.544	0.030	0.019	1.00	0.226	8.76	16.70
C1154a	19Cr-13Ni	0.100	1.44	0.06	0.051	0.53	0.44	13.08	19.31
1155	Cr-Ni-Mo (AISI 316)	0.046	1.63	0.020	0.018	0.502	0.169	12.18	18.45
1171	Cr-Ni-Ti (AISI 321)	0.067	1.80	0.018	0.013	0.54	0.121	11.2	17.4
1172	Cr-Ni-Nb (AISI 348)	0.056	1.76	0.025	0.014	0.59	0.105	11.35	17.40
1219	Cr-Ni (AISI 431)	0.149	0.42	0.026	0.001	0.545	0.162	2.16	15.64
1223	Chromium Steel	0.127	1.08	0.018	0.329	0.327	0.081	0.232	12.64
C1287	High Alloy (AISI 310 mod.)	0.36	1.66	0.029	0.024	1.66	0.58	21.16	23.98
C1288	High Alloy (A-743)	0.056	0.83	0.023	0.010	0.41	3.72	29.3	19.55
C1289	High Alloy (AISI 414 mod.)	0.014	0.35	0.017	0.021	0.156	0.205	4.13	12.12
1295	Cr (SAE 405)	0.027	0.387	0.022	0.0003	0.321	0.260	0.194	13.52
C1296	28Cr-3Mo (SAE 460)	0.038	0.256	0.024	0.013	0.66	0.056	0.373	27.90
1297	Cr-Ni-Mn (SAE 201)	0.066	7.11	0.038	0.0033	0.397	0.442	5.34	16.69

SRM	V	Mo	Co	Ti	N	Al	Nb	Ta	W	Pb	Zr
C1151a	0.040	0.79	0.033		(0.21)	(0.003)	(0.015)	(0.004)		0.0039	
C1152a	0.033	0.44	0.22		(0.055)	(0.004)	(0.15)	(0.001)		0.0047	
C1153a	0.176	0.24	0.127	(0.013)	(0.11)	(0.004)	(0.48)	(0.03)		0.006	(0.0001)
C1154a	0.135	0.068	0.38	(0.004)	(0.077)		(0.22)	(0.045)		0.017	(0.001)
1155	0.047	2.38	0.101							0.001	
1171		0.165	0.10	0.34							
1172		0.22	0.12				0.65	<0.001			
1219	0.056	0.164	(0.04)	(<0.001)	0.078	(0.001)	(0.01)	Sn (0.008)	(0.02)	(<0.0001)	B (<0.001)
1223	0.068	0.053	Mg (<0.0005)	(0.05)	(0.05)	(<0.005)		Sn (0.004)	Ca (<0.0005)		(0.0001)
C1287	0.09	0.46	0.31	0.050	(0.034)	(0.06)	(0.07)	O (0.017)		0.008	(0.006)
C1288	0.086	2.83	0.10	0.012	(0.028)	(0.0025)	(0.22)	O (0.029)	(0.2)	0.0041	(0.002)
C1289	0.007	0.82	0.035	0.005	(0.017)	(0.0016)	(0.10)	O (0.027)		0.0005	(0.001)
1295	0.082	0.023	0.020	(0.01)	Sn (0.02)	(0.20)	(<0.0005)	(<0.001)	(0.002)	(0.0001)	As (0.006)
C1296	0.134	3.43	0.026	0.23	Sn (<0.01)	0.035	0.20	(<0.001)	(<0.01)	(<0.001)	As (<0.01)
1297	0.080	0.331	0.127	(<0.0004)	Sn (<0.010)	(0.003)	(<0.009)	(<0.001)	(0.03)	(<0.0001)	As (0.005)

Values in parentheses are not certified and are given for information only.

101. Specialty Steels (disk form)

SRM	Type	Elemental Composition (in Wt. %)											
		C	Mn	P	S	Si	Cu	Ni	Cr	V	Mo	W	Co
1157	Tool (AISI M2)	0.836	0.34	0.011	0.004	0.18	0.088	0.228	4.36	1.82	4.86	6.28	0.028
1158	High Nickel (Ni 36)	0.025	0.468	0.004	0.005	0.194	0.039	36.03	0.062	0.001	0.010		0.008
1233	Valve Steel	0.502	9.16	0.031	0.002	0.219	0.375	3.43	21.08	0.096	0.237	(0.01)	

NOTE: SRM 1771, Cr-Al, and SRM 1772, Tool Steel S-7, are In Prep.

101. High Temperature Alloys (disk form)

SRM	Type	Elemental Composition (in Wt. %)					
		C	Mn	P	S	Si	Cu
1230	A 286	0.044	0.64	0.023	0.0007	0.43	0.14
1244	Inconel 600	0.062	0.29	0.010	0.003	0.12	0.26
1245a	Inconel 625	0.037	0.18	0.012	0.001	0.41	0.37
1246	Incoloy 800	0.082	0.91	0.018	0.001	0.18	0.49
1247	Incoloy 825	0.021	0.38	0.018	0.002	0.32	1.75
1250	Fe-Ni-Co	0.022	0.052	<0.003	0.0025	0.097	0.022
C2400	High Alloy Steel, ACI (17/4 PH)	0.036	0.71	0.013	0.003	0.61	2.63
C2401	High Alloy Steel (ACI-CD-4M Cu)	0.062	1.03	0.025	0.027	0.74	3.17
C2402	Hastelloy C	0.010	0.64	0.007	0.018	0.85	0.19

SRM	Ni	Cr	Mo	Co	Ti	Al	Nb	Ta	Fe	W	B
1230	24.2	14.8	1.18	0.15	2.12	0.24	(0.07)	V 0.23	(55)	(0.07)	0.0055
1244	73.2	15.7	0.20	0.058	0.25	0.26	(0.14)		9.6		<0.05
1245a	59.7	22.0	8.5	0.071	0.28	0.19	3.5	<0.01	4.5	<0.001	
1246	30.8	20.1	0.36	0.076	0.32	0.30	(0.09)		46.2		<0.001
1247	43.5	23.4	2.73	0.089	0.75	0.060	(0.46)		26.5		0.002
1250	37.78	0.077	0.014	16.1	1.48	0.99	2.99	0.003	40.5	V 0.077	0.0078
C2400	4.07	17.06	0.23	0.10			0.15	V 0.092		(0.1)	(0.0004)
C2401	5.46	25.1	2.13	0.19			(0.002)	V 0.20		(0.18)	(0.0004)
C2402	51.5	16.15	17.1	1.50 Sn (0.001)			(<0.01)	V 0.22	7.3	4.29	(0.0004)

Values in parentheses are not certified and are given for information only.

NOTE: SRM 1249, Inconel 718, SRM 1775, Refractory Alloy MP35N, and SRM 2175, Refractory Alloy MP35N, are In Prep.

101. Steelmaking Alloys (powder form)

These SRMs are for checking chemical methods of analysis for major constituents and for selected minor elements. They are furnished as fine powders (usually <0.1 mm).

SRM	Type	Unit Size (in g)	Elemental Composition (in Wt. %)								
			C	Mn	P	S	Si	Cu	Ni	O	
57a	Silicon Metal	60	0.024	0.015	0.003	0.003	98.55	0.004	0.008	(~0.3) (0.20)	
58a	Ferrosilicon (73% Si- Regular Grade)	75	0.014	0.16	0.009	<0.002	73.20	0.024	0.012		
59a	Ferrosilicon	50	0.046	0.75	0.016	0.002	48.10	0.052	0.033		
64c	Ferrochromium, High Carbon	100	4.68	0.16	0.020	0.067	1.22	0.005	0.43		
68c	Ferromanganese, High Carbon	100	6.72	80.04	0.19	0.008	0.225				
90	Ferrophosphorus	75			26.2						
195	Ferrosilicon (75% Si- High-Purity Grade)	75	0.034	0.17	0.017	0.001	75.3	0.047	0.032	(0.42)	
196	Ferrochromium, Low Carbon	100	0.035	(0.282)	0.020	0.003	0.373				
347	Magnesium Ferrosilicon	100	0.017	0.53	0.023	0.005	47.6	0.065	0.082		
689	Ferrochromium Silicon	100	0.043	0.32	0.026	0.002	39.5	0.013	0.20	(0.06)	
SRM	Cr	V	Mo	Ti	Al	Nb	Zr	Ca	Fe	B	As
57a	0.024	0.013	Pb <0.001	0.040	0.47		0.002	0.17	0.50	0.001	<0.001
58a	0.020	(0.002)	(0.01)	0.051	0.95	Co <0.01	0.002	0.30	25.23	0.0010	(0.0020)
59a	0.080				0.35			0.042	50.05	0.058	
64c	68.00	0.15		0.02		Co 0.051		N 0.045	24.98		
68c	0.074								12.3		0.021
90											
195	<0.01	(0.001)	(0.01)	0.037	0.046	Co <0.01	0.011	0.053	23.6	0.0010	(0.0024)
196	70.83	(0.12)									
347	0.14			0.036	0.78		Co 0.004	0.81	Mg 4.49	Ce 0.45	La 0.26
689	36.4	0.09	Pb(0.004)	0.40	0.049	Co 0.034	Bi (<0.003)	N (0.002)	23.2	0.0017	(0.009)

Values in parentheses are not certified and are given for information only.

101. Cast Irons (chip form)

These SRMs are furnished in 150-g units (unless otherwise noted) for use in checking chemical methods of analysis.

SRM	Type	Elemental Composition (in Wt. %)							
		C		Mn	P	S		Si	Cu
		Total	Graphitic			Grav	Comb		
4L	Cast	3.21	2.66	0.825	0.149		0.043	1.33	0.240
6g	Cast	2.85	2.01	1.05	0.557		0.124	1.05	0.502
7g	Cast (High Phosphorus)	2.69	2.59	0.612	0.794	0.061	0.060	2.41	0.128
82b	Cast (Ni-Cr)	2.85	2.37	0.745	0.025		0.007	2.10	0.038
107c	Cast (Ni-Cr-Mo)	2.99	1.98	0.480	0.079		0.059	1.21	0.205
115a	Cast (Cu-Ni-Cr)	2.62	1.96	1.00	0.086	0.064	0.065	2.13	5.52
122i	Cast	3.47		0.530	0.28		0.087	0.89	0.033
334	Gray Cast (Carbon & Sulfur)	2.83					0.043		
338	White Cast (Carbon & Sulfur)	3.33					0.015		
341	Ductile	1.81	1.23	0.92	0.024	0.007	0.007	2.44	0.152
342a	Nodular	1.86	1.38	0.274	0.019		0.006	2.73	0.135
890	HC 250 + V	2.91		0.62	0.025		0.015	0.67	0.055
891	Ni-Hard, Type I	2.71		0.55	0.038		0.029	0.56	0.150
892	Ni-Hard, Type IV	3.33		0.76	0.054		0.015	1.83	0.270

SRM	Ni	Cr	V	Mo	Co	Ti
4L	0.042	0.118	0.024	0.040	Zn(<0.001)	(0.03)
6g	0.135	0.370	0.056	0.035		0.059
7g	0.120	0.048	0.010	0.012		0.044
82b	1.22	0.333	0.027	0.002		0.027
107c	2.20	0.693	0.015	0.83		0.019
115a	14.49	1.98	0.014	0.050		0.020
122i	0.047	0.151	0.012	0.008		0.024
341	20.32	1.98	0.012	0.010		0.018
342a	0.058	0.034		0.006		0.020
890	0.397	32.4	0.45	0.018	(0.03)	
891	4.48	2.23	0.039	0.27	0.19	(0.01)
892	5.53	10.18	0.041	0.20	0.31	(0.02)

SRM	As	Sn	Al (total)	Mg	N	Fe
4L	(0.03)	(0.004)	(0.004)	Sb (<0.001)	(0.0016)	Pb (0.001)
6g	0.042				0.005	
7g	0.014				0.004	
341				0.068		
342a				0.070		
890	(0.008)		(<0.01)		(0.089)	(61.8)
891	(0.004)	(<0.01)	(0.008)		(0.012)	(88.5)
892	(0.006)	(0.02)	(0.009)		(0.019)	(77.4)

Values in parentheses are not certified and are given for information only.

NOTE: SRM 3e, White Iron and SRM 5m, Cast Iron, are In Prep.

101. Cast Steels, White Cast Irons and Ductile Irons (disk form)

These SRMs are for analysis of cast steels and cast irons by rapid instrumental methods.

SRM	Type	Elemental Composition (in Wt. %)							
		C	Mn	P	S	Si	Cu	Ni	Cr
C1137a	White Cast Iron	2.86	0.52	0.087	0.017	1.15	0.192	2.17	0.643
1138a	Cast Steel (No. 1)	0.118	0.35	0.035	0.056	0.25	0.09	0.10	0.13
1139a	Cast Steel (No. 2)	0.790	0.92	0.012	0.013	0.80	0.47	0.98	2.18
C1145a	White Cast Iron	2.92	0.187	0.215	0.191	0.271	0.46	0.62	0.63
C1146a	White Cast Iron	1.97	1.60	0.55	0.016	3.93	1.48	3.07	2.56
C1173	Cast Steel 3	0.453	0.174	0.031	0.092	1.38	0.204	4.04	2.63
1173	Ni-Cr-Mo-V Steel	0.423	0.19	0.033	0.092	1.28	0.204	4.06	2.70
C1290	High Alloy (HC-250 + V)	3.04	0.66	0.030	0.013	0.971	0.065	0.917	30.5
C1291	High Alloy (Ni-Hard, Type I)	2.67	1.14	0.028	0.032	1.34	0.26	4.34	2.78
C1292	High Alloy (Ni-Hard, Type IV)	3.47	0.55	0.049	0.016	0.59	0.36	5.04	11.4
C2423	Ductile Iron A	3.76	0.98	0.27	(0.0006)	1.67	1.55	0.146	0.322
C2423a	Ductile Iron B	3.66	0.91	0.246	(<0.001)	1.59	1.61	0.147	0.322
C2424	Ductile Iron C	2.68	0.268	0.041	0.024	3.37	0.125	0.061	0.13
C2424a	Ductile Iron D	2.76	0.207	0.034	0.016	3.30	0.099	0.045	0.15

SRM	V	Mo	Ti	As	Al	Co			
C1137a	0.019	0.86	(0.04)		(0.007)	Mg 0.032			
1138a	0.020	0.05	(0.0012)	(<0.005)	(0.067)	Fe (98.7)			
1139a	0.26	0.51	(0.004)	(<0.005)	(0.13)	Fe (93.0)			
C1145a	0.112	0.48	0.012	(0.02)	(0.04)				0.058
C1146a	0.20	1.52	0.20	(0.16)	(0.028)	Pb 0.0018			0.13
C1173	0.42	1.46	0.037	(0.02)	(0.005)	Pb (0.0006)			(0.064)
1173	0.42	1.50	(0.015)			Nb (0.045)			(0.064)
C1290	0.442	(0.041)							
C1291	0.031	0.32							
C1292	0.041	0.25							
C2423	0.048	0.155	0.10		(0.09)				(0.02)
C2423a	0.043	0.159	0.10		(0.08)				(0.02)
C2424	0.083	0.019	0.050		(<0.01)				(0.05)
C2424a	0.081	0.019	0.045		(<0.01)				(0.05)

SRM	Mg	Ce	La	B
C2423	0.058	0.036	0.011	(0.01)
C2423a	0.076	0.031	0.0042	(0.01)
C2424	0.006	0.0046	0.0011	(0.002)
C2424a	0.014	0.0053	0.0010	(0.001)

Values in parentheses are not certified and are given for information only.

NOTE: SRM C1150b, White Cast Iron and C2425b, Ductile Iron, are In Prep.

102. Nonferrous Metals

Aluminum Base Alloys (chip and disk forms)

These SRMs are for analyses of casting and other aluminum alloys by chemical and instrumental methods. SRMs 1710 through 1719 are specially prepared to include low levels of cadmium and lead encountered in the analysis of recycled aluminum.

SRM	Type	Unit Size (in g)	Elemental Composition (in Wt. %)						
			Mn	Si	Cu	Ni	Cr	V	Cd
87a	Al-Si	75	0.26	6.24	0.30	0.57	0.11	<0.01	
855a	Casting Alloy 356	30	0.057	7.07	0.13	0.016	0.013	(0.012)	Mn 0.060
856a	Casting Alloy 380 (fine millings)	30	0.35	9.21	3.51	0.37	0.055		
858	Alloy 6011	35	0.48	0.79	0.84	0.0006	0.0011	0.0030	
859	Alloy 7075	35	0.078	0.17	1.59	0.063	0.176	0.0082	
1258	Alloy 6011	disk	0.48	0.78	0.84	0.0006	0.0011		
1259	Alloy 7075	disk	0.079	0.18	1.60	0.063	0.173		
1710	Alloy 3004	disk							0.000843
1711	Alloy 3004	disk							0.002090
1712	Alloy 3004	disk							0.005165
1713	Alloy 5182	disk							0.000878
1714	Alloy 5182	disk							0.002013
1715	Alloy 5182	disk							0.00502

SRM	Ti	Sn	Ga	Fe	Pb	Mg	Zn	Zr	Be
87a	0.18	0.05	0.02	0.61	0.10	0.37	0.16		
855a	0.15	0.010	Sr 0.018	0.14	0.019	0.37	0.085	(0.003)	Ca (0.001)
856a	0.068	0.10		0.92	0.10	0.061	0.96		
858	0.042			0.078		1.01	1.04		<0.0001
859	0.041			0.202		2.45	5.46		0.0026
1258	(0.04)		(0.010)	0.079		0.98	1.03		<0.0001
1259	(0.04)		(0.022)	0.205		2.48	5.44		0.0025
1710					0.00177				
1711					0.00639				
1712					0.01559				
1713					0.001712				
1714					0.00653				
1715					0.01509				

Values in parentheses are not certified and are given for information only.

NOTE: SRM 853a, Alloy 3004 and SRM 854a, Alloy 5182;
SRM 1240c, Alloy 3004 and SRM 1241c, Alloy 5182, are In Prep.
SRM 1255b, Alloy 356 and SRM 1256b, Alloy 380;

102. Cobalt Base Alloys (chip and disk forms)

SRM	Type	Elemental Composition (in Wt. %)					
		C	Mn	P	S	Si	Cu
862	High Temperature Alloy L605—(chip)	0.120	1.59	0.002	0.0008	0.017	0.0010
1242	High Temperature Alloy L605—(disk)	0.126	1.58	0.002	0.0007	0.016	0.0010

SRM	Ni	Cr	V	Fe	W	Co	N	Al	Ta	Nb	B
862	9.74	20.0	0.005	1.80	15.1	51.5	0.026 (<0.01)	(<0.01)	(<0.005)	(<0.0001)	
1242	9.78	20.0	0.005	1.80	15.1	51.5	0.026 (<0.01)	(<0.01)	(<0.005)	(<0.0001)	

Values in parentheses are not certified and are given for information only.

102. Copper Base Alloys (chip and rod forms)

SRM	Type	Unit Size (in g)	Elemental Composition (in Wt. %)				
			Cu	Ni	Fe	Zn	Pb
158a	Bronze, Silicon	150	90.93	0.001	1.23	2.08	0.097
458	Beryllium-Copper (17510)	50	(97.9)	1.60	0.060	0.002	0.002
459	Beryllium-Copper (17200)	50	(97.7)	0.039	0.079	0.002	0.001
460	Beryllium-Copper (17300)	50	(97.5)	0.031	0.098	0.004	0.258
871	Bronze, Phosphor (CDA 521)	100	91.68		<0.001	0.025	0.010
872	Bronze, Phosphor (CDA 544)	100	87.36	0.003	4.0	4.13	
874	Cupro-Nickel, 10% (CDA 706) "High-Purity"	100	88.49	10.18	1.22	0.002	<0.0005
875	Cupro-Nickel, 10% (CDA 706) "Doped"	100	87.83	10.42	1.45	0.11	0.0092
879	Nickel Silver (CDA 762)	100	57.75	12.11	0.0020	30.04	0.002
880	Nickel Silver (CDA 770)	100	54.51	18.13	0.004	27.3	0.002
1034	Unalloyed Copper	rod	(99.96)	*(0.6)	*(2.0)	*(<11)	*(0.5)
1035	Leaded-Tin Bronze Alloy	50	(78.5)	(0.75)	(0.001)	(0.25)	(13.5)

SRM	Mn	Sb	Sn	Cr	P	Ag	Si	Al	Te	Cd	Se
158a	1.11		0.96		0.026		3.03	0.46			
458	(<0.002)	(<0.005)	0.004	0.004		(<0.01)	0.035	0.030			
459	(<0.003)	(<0.005)	0.005	0.005		(<0.003)	0.077	0.044			
460	(<0.003)	(<0.005)	0.006	0.005		(<0.002)	0.77	0.048			
871			8.14		0.082						
872			4.16		0.26						
874	0.0020	<0.001	0.007		0.002		(0.0006)			<0.0002	0.00015
875	<0.0007	<0.001	0.009		0.0020		(0.0008)		(<0.0001)	0.0022	0.0004
879	<0.001										
880	<0.001										
1034	*(<0.1)	*(0.2)	*(<0.2)	*(0.3)		*(8.1)	*(<2)	*(<2)	*(0.5)	*(<1)	*(3.3)
1035			(6.8)		(0.004)						

SRM	Bi	O	Co	C	Au	H	S	As	Mg	Ti
458			0.076	Be 0.360			(<0.002)	Zr (<0.002)	0.003	(<0.002)
459			0.221	Be 1.82			(<0.001)	Zr (<0.002)	0.007	(<0.003)
460			0.217	Be 1.86			(<0.001)	Zr (<0.002)	0.005	(<0.003)
874	<0.0002	(0.06)		(0.0023)		(0.0016)	(0.0011)	(<0.0006)	(0.0002)	(0.0001)
875	0.003	(0.14)		(0.0035)		(0.004)	(0.0011)	(0.0010)	(0.0010)	(<0.0002)
1034	*(0.2)	*(363)	*(0.2)		*(<0.05)		*2.8	*(0.2)	*(<1)	
1035		(0.64)					**22.3			

Values in parentheses are not certified and are given for information only.

* Value is in mg/kg (SI unit).

** Sulfur value is in mg/kg (SI unit).

102. Copper Base Alloys (block and disk forms)

The SRMs with a "C" prefix are chill-cast blocks, 31 mm square, 19 mm thick; the others are wrought disks, 31 mm in diameter and 19 mm thick. Both forms have nearly identical elemental compositions.

SRM	Type	Elemental Composition (in Wt. %)							
		Cu	Zn	Pb	Fe	Sn	Ni	Al	Sb
1104	Free-Cutting Brass	61.33	35.31	2.77	0.088	0.43	0.070		
1107	Naval Brass B	61.21	37.34	0.18	0.037	1.04	0.098		
1108	Naval Brass C	64.95	34.42	0.063	0.050	0.39	0.033		
1110	Red Brass B	84.59	15.20	0.033	0.033	0.051	0.053		
1111	Red Brass C	87.14	12.81	0.013	0.010	0.019	0.022		
1112	C1112 Gilding Metal A	93.38	6.30	0.057	0.070	0.12	0.100		
1113	C1113 Gilding Metal B	95.03	4.80	0.026	0.043	0.064	0.057		
1114	C1114 Gilding Metal C	96.45	3.47	0.012	0.017	0.027	0.021		
1115	C1115 Commercial Bronze A	87.96	11.73	0.013	0.13	0.10	0.074		
1116	C1116 Commercial Bronze B	90.37	9.44	0.042	0.046	0.044	0.048		
1117	C1117 Commercial Bronze C	93.01	6.87	0.069	0.014	0.021	0.020		
	C1122 Beryllium-Copper	97.45	(0.01)	(0.003)	0.16	(0.01)	(0.01)	0.17	
	C1123 Beryllium-Copper	97.10	0.01	(0.001)	0.04	(0.01)	(0.01)	0.02	
1276a	Cupro-Nickel (CDA 715)	67.8	0.038	0.004	0.56	0.023	30.5		0.0004
SRM		Be	Cd	Mn	P	Si			Ag
1104					0.005				
	C1106			0.005					
1108	C1108			0.025					
1112	C1112				0.009				
1113	C1113				0.008				
1114	C1114				0.009				
1115	C1115				0.005				
1116	C1116					0.008			
1117	C1117				0.002				
	C1122	1.75		(0.004)	(0.004)	0.17		(0.005)	
	C1123	0.46		(0.002)	(0.002)	0.03		(0.009)	
1276a			0.0002	1.01	0.006				
SRM		Co		Cr		Se			Mg
	C1122	0.220		(0.002)					
	C1123	2.35		(0.001)					
1276a		0.045				0.0005			0.12

Values in parentheses are not certified and are given for information only.

NOTE: SRM 1275a, Cupro-Nickel (CDA 706), in In Prep.

102. Copper "Benchmark" (chip and rod forms)

SRM		Type	Cu (in Wt. %)	Elemental Composition (in mg/kg*)							
Chip	Rod			Sb	As	Bi	Cr	Co	Fe	Pb	Mn
393		Unalloyed Copper "O"	99.998	0.25	0.41	<0.1	<0.5	0.02	<1	0.039	<0.01
394	494	Unalloyed Copper I	99.908	4.5	2.6	0.35	2.0	0.5	147	26.5	3.7
395	495	Unalloyed Copper II	99.944	8.0	1.6	0.50	6.0		96	3.25	5.3
396	496	Unalloyed Copper III	99.955	<1	<0.2	0.07	4.3	0.4	143	0.41	7.5
	457	Unalloyed Copper IV	99.96	0.2	0.2	0.2	(0.3)	(0.2)	2.0	0.5	<0.1
398		Unalloyed Copper V	99.98	7.5	25	2.0	(0.3)	2.8	11.4	9.9	(0.3)
	498		99.98	7.4	25	2.0	(0.3)	2.7	11	10	(0.3)
399	499	Unalloyed Copper VI	99.79	30	47	10.5	(0.5)	0.5	20.0	114	(0.3)
400	500	Unalloyed Copper VII	99.70	102	140	24.5	(0.5)	0.6	41	128	(0.2)
	C1252	Phosphorized Copper IX	99.89	42	115	21	7.4	90	(35)	60	(17)
	C1253	Phosphorized Copper X	99.42	(140)	432	70	216	495	(330)	244	(380)
454		Unalloyed Copper XI	99.84	24	46	19		(4)	(50)	66	

SRM		Ni	Se	Ag	S	Te	Sn	Zn	Al	Cd	Au	Mg
393		0.05	<0.05	0.10	<1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1
394	494	11.7	2.00	50.5	15	0.58	70	405	(<2)	(0.5)	(0.07)	(<1)
395	495	5.4	0.63	12.2	13	0.32	1.5	12.2	(<2)	(0.4)	(0.13)	(<1)
396	496	4.2	0.62	3.30	9.5	(0.02)	0.8	5.0	(<2)	(0.6)	(<0.05)	(<1)
	457	0.6	4.2	8.1	(4)	0.29	<0.2	<11	(<2)	(<1)	(<0.05)	(<1)
398		7.0	17.5	20.1	(11)	10.1	4.8	24	(<2)	(22)	(0.1)	(<1)
	498	7.0	17.5	20.1	(11)	10.1	5	25	(<2)	(<22)	(0.1)	(<1)
399	499	506	95	117	(10)	50	(~90)	45	(<2)	(<1)	(4)	(<1)
400	500	603	214	181	(9)	153	(~200)	114	(<2)	(<1)	(10)	(<1)
	C1252	128	53.6	166.6	(29)	51	(110)	60	(7)	14	34.9	(20)
	C1253	(500)	164	495	55	199	(470)	350	(180)	74	74.4	(80)
454		(150)	479	286		27	2.2	7			7.5	

SRM		Si	Be	B	Ca	Li	Pd	P	Ti	Zr
393	494	<0.5	<0.01	<0.01	<0.05	<0.01	<0.05	<0.05	<0.5	<0.5
394	494	(<2)								
395	495	(<2)								
396	496	(<2)								
398		(<2)								
	498	(<2)								
399	499	(<2)								
400	500	(<2)								
	C1252	(13)	(<5)		(6)	(0.03)				
	C1253	(350)	(12)		(1)	(9)		518		
454							(0.1)			

Values in parentheses are not certified and are given for information only.

*SI unit. Replaces terms "ppm" and "µg/g".

102. Naval Brass (disk form)

This series of SRMs was produced through a cooperative program between NIST and the Institute for Non-Ferrous Metals (IMN), Gliwice, Poland and funded under the auspices of the Second Maria Sklodowska-Curie Fund. Development, characterization and certification of the monolithic brasses were carried out by the IMN; homogeneity testing was performed by NIST. A detailed technical discussion of these SRMs will be given in a Special Publication due to be published in mid-1995. Each SRM unit is in the form of disk, ~39.5 mm in diameter and 20 mm thick.

SRM	Type	Elemental Composition (in Wt. %)				
		Cu	Pb	Fe	Sn	Ni
1776	Naval Brass WK1	59.97	0.17	0.28	0.11	0.28
1777	Naval Brass WK2	60.56	0.33	0.16	1.34	0.21
1778	Naval Brass WK3	62.10	0.11	0.06	0.49	0.13
1779	Naval Brass WK4	63.28	0.05	0.08	1.04	0.07
1780	Naval Brass WK5	64.92	0.006	0.01	0.47	0.005

SRM	Al	Sb	Mn	P	Si	Bi
1776	0.11	0.024	0.12	0.030	0.30	0.014
1777	0.08	0.019	0.09	0.018	0.23	0.012
1778	0.04	0.013	0.04	0.018	0.15	0.009
1779	0.01	0.006	0.02	0.011	0.08	0.005
1780	0.004	0.002	0.006	0.006	0.006	0.001

102. Lead Base Alloys (chip and disk forms)

SRM		Type	Elemental Composition (in Wt. %)							
Chip	Disk		Cu	Ni	As	Sn	Sb	Bi	Ag	Fe
1129		Solder 63Sn-37Pb	0.16	0.010	0.055	62.7	0.13	0.13	0.075	
127b	1131	Solder 40Sn-60Pb	0.011	0.012	0.01	39.3	0.43	0.06	0.01	
53e	1132	Bearing Metal(Pb-Sb-Sn)	0.054	0.003	0.057	5.84	10.26	0.052		<0.001

102. Lead Base Material (disk form)

These SRMs are issued in the form of disks, 50 mm in diameter and 16 mm thick. They are intended for use with optical emission spectrometric methods of analysis.

SRM	C2415	C2416	C2417	C2418
Type	Battery Lead	Bullet Lead	Lead-Base Alloy	High-Purity Lead
Elemental Composition (in Wt. %)				
Sb	2.95	0.79	0.010	(<0.0001)
As	0.20	0.056	0.011	(<0.0001)
Bi	0.054	0.10	0.010	(<0.0005)
Cu	0.095	0.065	0.010	(<0.0001)
S	0.0026	0.0015	(<0.0005)	
Ag	0.002	0.0044	0.010	0.0001
Sn	0.33	0.09	(<0.010)	(<0.0005)
Al	(<0.0003)	(<0.0001)	(<0.0001)	(<0.0001)
Cd	0.002	(0.0002)	(<0.0002)	0.0003
Ca	(<0.001)	(<0.001)	(<0.001)	(<0.0005)
Co		(<0.0002)	(<0.0002)	(<0.0005)
Fe	<0.001	(<0.0005)	(<0.0003)	(<0.0005)
Mn	<0.001	(<0.0005)	(<0.0003)	(<0.0005)
Ni	<0.001	(<0.0005)	(<0.0005)	(<0.0005)
Te	0.0045	(<0.0005)	(<0.0005)	(<0.0005)
Zn	<0.001	(<0.0005)	(<0.0005)	(<0.0005)

Values in parentheses are not certified and are given for information only.

102. Tin Base Alloys (chip form)

SRM	Type	Unit Size (in g)	Elemental Composition (in Wt. %)								
			Pb	Sn	Sb	Bi	Cu	Fe	As	Ag	Ni
54d	Bearing Metal	170	0.62	88.57	7.04	0.044	3.62	0.027	0.088	0.0032	0.0027

102. Nickel Base Alloys (chip and disk forms)

SRM	Type	Unit Size (in g)	Elemental Composition (in Wt. %)								
			C	Mn	P	S	Si	Cu	Ni	Cr	
349a	Waspaloy Ni-Co-Cr	150	0.035	0.019	0.003	0.0024	0.018	0.007	58.1	19.3	
864	Inconel, 600	100	0.064	0.29	0.010	0.003	0.12	0.26	73.1	15.7	
865	Inconel, 625	100	0.037	0.18	0.012	0.001	0.41	0.36	59.5	21.9	
866	Incoloy, 800	100	0.082	0.92	0.017	0.001	0.17	0.49	30.8	20.1	
867	Incoloy, 825	100	0.021	0.39	0.018	0.002	0.32	1.74	43.5	23.4	
882	Ni-Cu-Al	100	0.006	0.0007		0.0014	0.006	31.02	65.25		
1159	Electronic and Magnetic Alloy Ni-Fe	disk	0.007	0.305	0.003	0.003	0.32	0.038	48.2	0.06	
1160	Electronic and Magnetic Alloy Ni-Mo	disk	0.019	0.550	0.003	0.001	0.37	0.021	80.3	0.05	
1243	Waspaloy	disk	0.024	0.019	0.003	0.0018	0.018	0.007	58.78	19.20	
C1248	Ni-Cu	disk	0.266	0.31	0.002	0.0008	1.61	29.80	65.75	0.095	

SRM	Mo	Co	Ti	Al	B	Fe	Nb
349a	4.25	12.46	3.06	1.23	0.005	1.15	V 0.12
864	0.20	0.059	0.26	0.26	<0.005	9.6	(0.14)
865	8.6	0.072	0.28	0.21	<0.001	4.5	3.5
866	0.36	0.075	0.31	0.29	<0.001	46.1	(0.09)
867	2.73	0.089	0.75	0.062	0.002	26.6	(0.45)
882			0.57	2.85		0.009	
1159	0.010	0.022				51.0	
1160	4.35	0.054				14.3	
1243	4.25	12.46	3.06	1.23	0.005	0.79	V 0.12
C1248	0.006	Pb 3.8 mg/kg*	Sn 1.1 mg/kg*	0.009		2.10	Zn 3 mg/kg*

Values in parentheses are not certified and are given for information only.

*SI unit. Replaces terms "ppm" and "μg/g".

NOTE: SRM 863, Inconel 718, is In Prep.

102. Trace Elements in Nickel Base Superalloys (chip form)

SRM	Type	Unit Size (in g)	Trace Composition (in mg/kg*)				
			Pb	Bi	Se	Te	Tl
897	"Tracealloy" A	35	11.7	(0.5)	9.1	1.05	0.51
898	"Tracealloy" B	35	2.5	(1.0)	2.00	0.54	2.75
899	"Tracealloy" C	35	3.9	(0.3)	9.5	5.9	0.252

SRM	Base Composition (in Wt. %)											
	C	Cr	Co	Ni	W	Nb	Al	Ti	B	Zr	Ta	Hf
897, 898, 899	(0.12)	(12.0)	(8.5)	(Bal)	(1.75)	(0.9)	(2.0)	(2.0)	(0.010)	(0.10)	(1.75)	(1.2)

Values in parentheses are not certified and are given for information only.

*SI unit. Replaces terms "ppm" and "μg/g".

102. Nickel Oxides (powder form)

SRM	Type	Unit Size (in g)	Elemental Composition (in Wt. %)								
			Mn	Si	Cu	Cr	Co	Ti	Al	Fe	Mg
671	Oxide 1	25	0.13	0.047	0.20	0.025	0.31	0.024	0.009	0.39	0.030
672	Oxide 2	25	0.095	0.11	0.018	0.003	0.55	0.009	0.004	0.079	0.020
673	Oxide 3	25	0.0037	0.006	0.002	0.0003	0.016	0.003	0.001	0.029	0.003

SRM	Trace Composition (in mg/kg*)											
	Pb	Se	Bi	As	Sn	Sb	Cd	Ga	Ag	Te	Tl	Zn
671	16	2.0	0.07	(59)	(2.7)	(0.4)	(0.7)	(0.8)	(0.5)	(<0.2)	(<0.1)	(160)
672	38	0.40	0.3	(74)	(4)	(0.5)	(1.7)	(0.4)	(0.3)	(<0.2)	(<0.1)	(140)
673	3.5	0.2	0.06	(0.4)	(<0.5)	(<0.5)	(0.05)	(<0.1)	(<0.1)	(0.4)	(<0.1)	(1.7)

Values in parentheses are not certified and are given for information only.

*SI unit. Replaces terms "ppm" and "µg/g".

102. Titanium Base Alloys (chip and disk forms)

SRM	Type	Unit Size (in g)	Elemental Composition (in Wt. %)				
			C	Mn	Cr	Cu	Mo
173b	Al-V	50	0.025			0.008	0.013
176	Al-Sn	100	0.015	0.0008		0.003	0.0003
641	8 Mn (A)	disk		6.68			
642	8 Mn (B)	disk		9.08			
643	8 Mn (C)	disk		11.68			
644	Cr-Fe-Mo	disk			1.03		3.61
647	Al-Mo-Sn-Zr	50	0.006				1.96
648	Al-Sn-Zr-Cr-Mo	50	0.011		3.84		3.75
649	V-Al-Cr-Sn	50	0.011	(<0.01)	2.96	(<0.001)	
650	Unalloyed A	30		0.016	0.002	0.033	0.002
651	Unalloyed B	30		0.005	0.037	0.032	0.031
652	Unalloyed C	30		0.046	0.082	0.081	0.039
654b	Al-V	disk			(0.025)	0.004	(0.013)
1128	V-Al-Cr-Sn	disk	0.011	(<0.01)	2.96	(<0.003)	(0.006)
2431	6Al-2Sn-4Zr-10Mo	50	0.006	(<0.01)	(<0.01)	(<0.01)	6.01
2432	10V-2Fe-3Al	50	0.008	(<0.01)	(<0.01)	(<0.005)	

SRM	Fe	Al	V	Sn	Si	N	W	Zr
173b	0.23	6.36	4.31	(0.03)	0.046	0.015		
176	0.070	5.16		2.47		0.010		
644	1.36							
647	0.075	5.88	(<0.02)	2.02		(<0.01)		3.90
648	0.15	5.13		1.98	0.027	(0.01)		1.84
649	0.133	3.08	15.1	3.04		(0.01)		
650	0.024	<0.01	0.009	0.03	0.004		1.55	
651	0.058	<0.006	0.021	0.026	0.011		0.39	
652	0.67	0.039	0.024	0.053	0.16		0.5	
654b	0.023	6.34	4.31	0.023	0.045		Ni 0.028	0.008
1128	0.134	3.06	15.13	3.04		(0.01)		
2431	0.056	5.73	(<0.01)	1.98	0.088	Ni (<0.01)	(<0.001)	4.06
2432	1.77	3.15	10.00	B (<0.001)	0.029	Ni (<0.01)	(<0.001)	(<0.01)

Values in parentheses are not certified and are given for information only.

NOTE: SRM 2433, 8Al-1Mo-1V, is In Prep.

102. Zinc Base Alloys (chip and disk forms)

SRM	Type	Unit Size (in g)	Elemental Composition (in Wt. %)							
			Cu	Al	Mg	Fe	Pb	Cd	Sn	Cr
94c	Die Casting Alloy	150	1.01	4.13	0.042	0.018	0.006	0.002	0.006	
625	Zinc-base A-ASTM AG 40A	disk	0.034	3.06	0.070	0.036	0.0014	0.0007	0.0006	0.0128
626	Zinc-base B-ASTM AG 40A	disk	0.056	3.56	0.020	0.103	0.0022	0.0016	0.0012	0.0395
627	Zinc-base C-ASTM AG 40A	disk	0.132	3.88	0.030	0.023	0.0082	0.0051	0.0042	0.0038
628	Zinc-base D-ASTM AC 41A	disk	0.611	4.59	0.0094	0.066	0.0045	0.0040	0.0017	0.0087
629	Zinc-base E-ASTM AC 41A	disk	1.50	5.15	0.094	0.017	0.0135	0.0155	0.012	0.0008
630	Zinc-base F-ASTM AC 41A	disk	0.976	4.30	0.030	0.023	0.0083	0.0048	0.0040	0.0031
631	Zinc spelter (mod.)	disk	0.0013	0.50 (<0.001)	0.005	(0.001)	0.0002	0.0001	0.0001	

SRM	Mn	Ni	Si	In	Ga	Ca	Ag	Ge
94c	0.014	0.006						
625	0.031	0.0184	0.017					
626	0.048	0.047	0.042					
627	0.014	0.0029	0.021					
628	0.0091	0.030	0.008					
629	0.0017	0.0075	0.078					
630	0.0106	0.0027	0.022					
631	0.00015 (<0.0005)	(0.002)	0.0023	(0.002)	<0.001	(<0.0005)	(0.0002)	

Values in parentheses are not certified and are given for information only.

102. Zirconium Base Alloys (chip and disk forms)

SRM	Type	Unit Size (in g)	Elemental Composition (in Wt. %)										
			C	Mn	Hf	Cu	Ni	Cr	Ti	Sn	Fe	N	Al
360b	Zircaloy-4	100	0.011	0.0010	0.008	0.002	0.0025	0.10	0.002	1.55	0.21	0.0045	0.004

SRM	Type	Unit Size	Elemental Composition (in mg/kg*)											
			Hf	C	Cr	Cu	Fe	Mn	Mo	Ni	N	Si	Ti	W
1235	Zirconium B	disk	95	(170)	(60)	(80)	(850)	(25)	(40)	(65)	(32)	(95)	(90)	(50)

Values in parentheses are not certified and are given for information only.

*SI unit. Replaces terms "ppm" and "µg/g".

102. Gases in Metals (platelet form)

SRM	Type	Hydrogen (in mg/kg*)
352c	Unalloyed Titanium for Hydrogen	49

*SI unit. Replaces terms "ppm" and "µg/g".

103. Microanalysis

Metals (rod and wire forms)

SRM	Type	Elemental Composition (in Wt. %)				
		Au	Cu	Ag	W	Mo
480	Tungsten-20% Mo Alloy				78.5	21.5
481	Au 100 A	100.00				
	Au-20% Ag B	80.05		19.96		
	Au-40% Ag C	60.05		39.92		
	Au-60% Ag	40.03		59.93		
	Au-80% Ag E	22.43		77.58		
	Ag 100 F			100.00		
482	Au 100 A	100.00				
	Au-20% Cu B	80.15	19.83			
	Au-40% Cu C	60.36	39.64			
	Au-60% Cu	40.10	59.92			
	Au-80% Cu E	20.12	79.85			
	Cu 100 F		100.00			

103. Synthetic Glasses (rod form)

	SRM 1872			SRM 1873		
	Glass			Glass		
	K-453	K-491	K-968	K-458	K-489	K-963
Composition (in Wt. %)						
Pb	(99.37)	(99.38)	(100.07)	(99.71)	(99.71)	(100.02)
Pb	54.21	54.69	54.74		(1.32)	
Si		(0.11)		23.05	(22.23)	(21.96)
Ge	28.43	26.10	25.93			(0.47)
Ba			(0.46)	41.79	39.53	39.21
Zn				3.01	2.93	2.95
P			(0.21)			(0.33)
Mg			(0.22)			(0.34)
Al		(0.10)			(0.11)	
B						
Zr		(0.26)	(0.48)		(0.40)	(0.61)
Ti		(0.14)	(0.16)		(0.27)	(0.32)
Ce		(0.59)			(0.80)	
Ta		(0.52)			(0.95)	
Fe		(0.17)			(0.35)	
Li						
Ni			(0.20)			(0.33)
Eu			(0.64)			(0.95)
U			(0.05)			(0.16)
Th			(0.12)			(0.06)
Cr			(0.19)			(0.31)
O	(16.73)	(16.45)	(16.67)	(31.86)	(31.70)	(32.00)
Total	(99.37)	(99.13)	(100.07)	(99.71)	(100.59)	(100.00)

Values in parentheses are not certified and are given for information only.

103. Thin Film for Transmission Electron Microscope

SRM	Type	Elemental Composition (in Wt. %)					
		Mg	Si	Ca	Fe	O	Ar
2063a	Mineral glass	7.97	25.34	11.82	11.06	43.2	(0.4)

Values in parentheses are not certified and are given for information only.

104. High-Purity Materials

High-Purity Metals (solid forms)

These SRMs are for determining impurity elements in high-purity metals.

SRM	Type	Unit Size	Elemental Composition (in mg/kg*)				
			Cu	Ni	Sn	Pb	Zr
685R	High-Purity Gold (Rod)	5.9 mm × 25 mm long	0.1	(<0.05)	(<0.07)		
685W	High-Purity Gold (Wire)	1.4 mm × 102 mm long	0.1	(<0.05)	(<0.07)		
680a	High-Purity Platinum (Wire)	0.51 mm: L1 (10 cm) 0.51 mm; L2 (1 m)	0.1	<1		<1	<0.1
682	High-Purity Zinc	semicirc 57 mm	0.042	(<0.1)	(0.02)		
683	Zinc Metal	semicirc 57 mm	5.9		(0.02)	11.1	
726	Selenium, Intermediate Purity	shot, 450 g	<1	<0.5	<1	<1	Mn <0.3
728	Zinc, Intermediate Purity	shot, 450 g	In Prep				
†885	Refined Copper	pin, 200 g	<0.0001		<0.0001	0.0002	

SRM	Ag	Mg	In	Fe	O	Pd	Au	Rh	Ir	Cd	Tl
685R	[0.1]	(<0.2)	0.007	0.2	[<2]						
685W	[0.1]	(<0.2)	0.007	0.3	[2]						
680a	<0.1	<1		1.3	4	0.2	<1	<0.2	<0.01		
682	(0.02)	(<0.1)		(0.1)	(<0.5)					(0.1)	
683	1.3			2.2						1.1	(0.2)
726	<1	<1	S 12	1	Cr <1	Mo <0.3	Te 0.3	As <2	Al <1	B <1	Ca <1
†885	0.0005			<0.0005	0.31		S 0.0018	Sb <0.0002	As <0.0002	Bi <0.0001	Zn <0.0001

Values in parentheses are not certified and are given for information only.

Values in brackets are subject to greater error since only one method of analysis was employed.

* SI unit: Replaces terms "ppm" and "µg/g".

† SRM 885 values are in Wt. %.

104. Stoichiometry (powder form)

These SRMs are defined as primary, working, and secondary standards in accordance with recommendations of the Analytical Chemistry Section of the International Union of Pure and Applied Chemistry [Ref. Analyst 90, 251 (1965)]. These definitions are as follows:

Primary Standard:

a commercially available substance of purity 100 ± 0.02 percent (Purity 99.98 + percent).

Working Standard:

a commercially available substance of purity 100 ± 0.05 percent (Purity 99.95 + percent).

Secondary Standard:

a substance of lower purity which can be standardized against a primary grade standard.

SRM	Type	Unit Size (in g)	Certified Use	Stoichiometric Purity (in %)
17d	Sucrose	60	Polarimetric Value	(99.9)
40h	Sodium Oxalate	60	Reductometric Value	99.972
41c	Dextrose (D-Glucose)	70	Reductometric Value	99.9
83d	Arsenic Trioxide	60	Reductometric Value	99.9926
84j	Potassium Hydrogen Phthalate	60	Acidimetric Value	99.996
136e	Potassium Dichromate	60	Oxidimetric Value	99.984
350a	Benzoic Acid	30	Acidimetric Value	99.9958
723b	Tris(hydroxymethyl)aminomethane	50	Basimetric Value	99.9238
951	Boric Acid	100	Acidimetric and Boron Isotopic Value	100.00
987	Strontium Carbonate	1	Assay and Isotopic	99.98
999a	Potassium Chloride	60	Assay Standard for: Potassium Chloride	In Prep In Prep

Values in parentheses are not certified and are given for information only.

104. Microchemistry (powder form)

SRM	Type	Unit Size (in g)	Composition (in Wt. %)							
			C	H	N	Br	Cl	F	S	CH ₃ O-
141d	Acetanilide	In Prep								
142	Anisic Acid	2								20.40
143c	Cystine	2	29.99	5.03	11.66				26.69	
148	Nicotinic Acid	2	58.54	4.09	11.38					
2141	Urea	2			46.63					
2142	o-Bromobenzoic Acid	2				39.80				
2143	p-Fluorobenzoic Acid	2						13.54		
2144	m-Chlorobenzoic Acid	2					22.62			

104. Spectrometry, Single Element (solution form)

These SRMs are intended as standard stock solutions for use in atomic absorption spectrometry, optical emission (plasma) spectrometry, or any other analytical technique that requires aqueous solutions for calibrating instruments. Each SRM is a single element solution of 50 mL with a nominal concentration of 10 mg/mL, except where noted in the Element column.

SRM	Element	Acid Concentration
3101a	Aluminum	HNO ₃ 10%
3102a	Antimony	HNO ₃ 10% + HF 2%
3103a	Arsenic	HNO ₃ 10%
3104a	Barium	HNO ₃ 1%
3105a	Beryllium	HNO ₃ 10%
3106	Bismuth	HNO ₃ 10%
3107	Boron (5 mg/mL)	H ₂ O
3108	Cadmium	HNO ₃ 10%
3109a	Calcium	HNO ₃ 10%
3110	Cerium	HNO ₃ 10%
3111a	Cesium	HNO ₃ 1%
3112a	Chromium	HNO ₃ 10%
3113	Cobalt	HNO ₃ 10%
3114	Copper	HNO ₃ 10%
3115a	Dysprosium	HNO ₃ 10%
3116a	Erbium	HNO ₃ 10%
3117a	Europium	HNO ₃ 10%
3118a	Gadolinium	HNO ₃ 10%
3119a	Gallium	HNO ₃ 10%
3120	Germanium	Oxalic Acid 10%
3121	Gold	HCl 10%
3122	Hafnium	HNO ₃ 10% + HF 2%
3123a	Holmium	HCl 10%
3124a	Indium	HNO ₃ 10%
3126a	Iron	HNO ₃ 10%
3127a	Lanthanum	HNO ₃ 10%
3128	Lead	HNO ₃ 10%
3129a	Lithium	HNO ₃ 1%
3130a	Lutetium	HNO ₃ 10%
3131a	Magnesium	HNO ₃ 10%
3132	Manganese	HNO ₃ 10%
3133	Mercury	HNO ₃ 10%
3134	Molybdenum	HCl 10%
3135a	Neodymium	HNO ₃ 10%
3136	Nickel	HNO ₃ 10%
3137	Niobium	5% HNO ₃ + HF 2%
3138	Palladium	HCl 10%
3139a	Phosphorus	HNO ₃ 0.05%
3140	Platinum	HCl 10%
3141a	Potassium	HNO ₃ 1%
3142a	Praseodymium	HNO ₃ 10%
3143	Rhenium	HNO ₃ 10%
3144	Rhodium (1 mg/mL)	HCl 10%
3145a	Rubidium	HNO ₃ 1%

104. Spectrometry, Single Element (solution form) – Continued

SRM	Element	Acid Concentration
3147a	Samarium	HNO ₃ 10%
3148a	Scandium	HNO ₃ 10%
3149	Selenium	HNO ₃ 10%
3150	Silicon	H ₂ O
3151	Silver	HNO ₃ 10%
3152a	Sodium	HNO ₃ 1%
3153a	Strontium	HNO ₃ 10%
3154	Sulfur	H ₂ O
3155	Tantalum	HNO ₃ 5% + HF 2%
3156	Tellurium	HCl 20%
3157a	Terbium	HNO ₃ 10%
3158	Thallium	HNO ₃ 10%
3159	Thorium	HNO ₃ 10%
3160a	Thulium	HNO ₃ 10%
3161	Tin	HCl 60%
3162a	Titanium	HNO ₃ 10% + HF 2%
3163	Tungsten	HNO ₃ 7% + HF 4%
3164	Uranium	HNO ₃ 10%
3165	Vanadium (5 mg/mL)	HNO ₃ 10%
3166a	Ytterbium	HNO ₃ 10%
3167a	Yttrium	HNO ₃ 10%
3168a	Zinc	HCl 10%
3169	Zirconium	HNO ₃ 10% + HF 2%

104. Spectrometry, Multi-Element (solution form)

SRMs 3171a and 3172a consist of single 50-mL solutions, each containing several elements in concentration ratios appropriate for natural water and similar type sample analysis. Multi-element SRM 3179 consists of a set of three 50-mL solutions, (3179-I, 3179-II and 3179-III), designed to be combined, diluted (I, 1:100; II and III, 1:1000) and used immediately, as the full combination of elements is unstable over extended periods of time. The elemental concentration ratios in the final combined and diluted solution of SRM 3179 are appropriate for the analysis of soil, sediment and sludge leachates.

Element	Source, Purity (in Wt. %)	Nominal Concentration (in µg/mL)
SRM 3171a Multielement Mix A1 Standard Solution (in HNO ₃ 5%)		
Aluminum	Metal, (99.99 +)	100 ± 0.5
Antimony	Metal, (99.99)	100 ± 0.5
Beryllium	Metal, (99.9)	10 ± 0.1
Cadmium	Metal, (99.99 +)	100 ± 0.5
Chromium	Metal, (99.99 +)	100 ± 0.5
Iron	Metal, (99.99 +)	100 ± 0.5
Magnesium	Metal, (99.999)	100 ± 0.5
Manganese	Metal, (99.99)	100 ± 0.5
Molybdenum	Metal, (99.99 +)	100 ± 0.5
Nickel	Metal, (99.999)	100 ± 0.5
Potassium	KCl, (99.98)	500 ± 2.5
Sodium	NaCl, (99.98)	100 ± 0.5
Vanadium	Metal, (99.97)	100 ± 0.5

104. Spectrometry, Multi-Element (solution form) – Continued

Element	Source, Purity (in Wt. %)	Nominal Concentration (in µg/mL)
SRM 3172a Multielement Mix B1 Standard Solution (in HNO ₃ 5%)		
Arsenic	Metal, (99.83)	200 ± 1.0
Barium	BaCO ₃ , (99.88)	10 ± 0.1
Calcium	CaCO ₃ , (99.99)	10 ± 0.1
Cobalt	Metal, (99.92)	100 ± 0.5
Copper	Metal, (99.9)	100 ± 0.5
Lead	Metal, (99.99)	100 ± 0.5
Selenium	Metal, (99.99)	500 ± 2.5
Silver	Metal, (99.999 +)	100 ± 0.5
Strontium	SrCO ₃ , (99.99)	10 ± 0.1
Thallium	Metal, (99.99)	100 ± 0.5
Zinc	Metal, (99.99 +)	100 ± 0.5
SRM 3179 Multielement Mixes I, II, and III Standard Solutions (in HNO ₃ 5%)		
I Aluminum	Metal, (99.99 +)	100 ± 0.5
Arsenic	Metal, (99.99)	200 ± 1.0
Iron	Metal, (99.99 +)	199 ± 1.0
Lead	Metal, (99.99)	100 ± 0.5
Magnesium	Metal, (99.999)	100 ± 0.5
Manganese	Metal, (99.99)	100 ± 0.5
Phosphorus	NH ₄ H ₂ PO ₄ , (99.9)	100 ± 0.5
Potassium	KCl, (99.98)	100 ± 0.5
Sodium	NaCl, (99.98)	100 ± 0.5
Vanadium	NH ₄ VO ₃ , (99.99)	50 ± 0.2
Zinc	Metal, (99.99 +)	100 ± 0.5
II Barium	BaCO ₃ , (99.99)	100 ± 0.5
Cadmium	Metal, (99.99 +)	100 ± 0.5
Calcium	CaCO ₃ , (99.99)	100 ± 0.5
Chromium	Metal, (99.99)	100 ± 0.5
Cobalt	Metal, (99.98)	99.5 ± 0.5
Copper	Metal, (99.99)	100 ± 0.5
Lanthanum	La ₂ O ₃ , (99.99)	100 ± 0.5
Lithium	Li ₂ CO ₃ , (99.9)	100 ± 0.5
Molybdenum	Metal, (99.99 +)	97.5 ± 0.5
Nickel	Metal, (99.999)	100 ± 0.5
Strontium	SrCO ₃ , (99.99)	100 ± 0.5
III Silver	Metal, (99.999)	100 ± 0.5

104. Chromium Speciation (solution form)

These SRMs are intended for use in conjunction with the measurement of specific species of chromium, and consist of 50 mL solutions.

SRM	Source, Purity, %	Diluent	Element Concentration (in mg/mL)	
			Cr (III)	Cr (VI)
2108	Metal, (99.999 +)	HCl, 1%	1.000 ± 0.005	< 0.001
2109	SRM 136c (99.984)	deionized H ₂ O	< 0.005	1.000 ± 0.005

104. Anion Chromatography (solution form)

These SRMs are single-component solutions prepared gravimetrically for use in anion chromatography, or any other technique that requires aqueous standard solutions for calibration on control materials.

SRM	Anion	Unit Size (in mL)	Nominal Concentration (in mg/kg*)
3181	Sulfate	50	1000
3182	Chloride	50	1000
3183	Fluoride	50	1000
3184	Bromide	50	1000
3185	Nitrate	50	1000
3186	Phosphate	50	1000

*SI unit. Replaces terms "ppm" and "µg/g".

104. Stable Isotopic Materials (solid forms)

The isotopic composition of these SRMs has been determined by mass spectrometry.

SRM	Type	Element/Isotopic Composition Certified	Unit Size (in g)
951	Boric Acid, assay and isotopic	Boron	100
952	Boric Acid, 95% enriched ¹⁰ B, assay and isotopic	Boron	0.25
975	Sodium Chloride	Chlorine	0.25
976	Copper Metal	Copper	0.4
977	Sodium Bromide	Bromine	0.25
978a	Silver Nitrate	Silver	0.25
979	Chromium Nitrate	Chromium	0.25
980	Magnesium Metal	Magnesium	0.25
981	Lead Metal, natural	Lead	1.0
*982	Lead Metal, equal atom (²⁰⁸ Pb/ ²⁰⁶ Pb)	Lead	1.0 wire
*983	Lead Metal, radiogenic (92% ²⁰⁶ Pb)	Lead	1.0 wire
984	Rubidium Chloride, assay and isotopic	Rubidium	0.25
985	Potassium Chloride, assay and isotopic	Potassium	1.0
986	Nickel	Nickel	1.0
987	Strontium Carbonate, assay and isotopic	Strontium	1.0
989	Rhenium, assay and isotopic	Rhenium	pkg. (50)
990	Silicon, assay and isotopic	Silicon	3 cm × 0.2 cm wafer
991	Lead-206 Spike, assay and isotopic	Lead	15
994	Gallium Metal, isotopic	Gallium	0.25
997	Thallium Metal, isotopic	Thallium	0.25

* These SRMs are radioactive, containing Lead-210 of natural origin. All users and purchasers must comply with all national and international regulations regarding the use and disposal of these SRMs.

104. Royal Canadian Mint Reference Materials (solid forms)

These RMs are a series each of fine silver, fine gold, and gold bullion products developed and certified by the Royal Canadian Mint (RCM), Ottawa, Canada. The fine silver and fine gold RMs are primarily intended for use as calibration standards for the determination of trace elements by solid sample spectro-metric methods; the gold bullion RMs are primarily intended for use as quality control check standards for fire assay. There are eight RMs in the fine silver series, five RMs in the gold bullion series, and six RMs in the fine gold series. The RMs in the fine silver series are currently available only in block form (24 mm × 24 mm × 5 mm). The RCM expects to issue the wire and turnings forms at a future date. The RMs in the gold bullion series are also available in three forms — disc (25 mm dia. × 20 mm), foil (35 mm × 40 mm × 1 mm), and wire (2 mm dia.). The RMs in the fine gold series are available in three forms — block (25 mm × 25 mm × 2.5 mm), wire (2 mm dia.), and turnings (25 g).

RM Type Form (Block, Wire, Turnings) Unit Size (in g)	8153/8154/8155 Fine Silver			8156/8157/8158 Fine Silver			8159/8160/8161 Fine Silver		
	B	W*	T*	B	W*	T*	B	W*	T*
	30	25	25	30	25	25	30	25	25
Components (in mg/kg)									
Bi		39.1			77.0			135	
Cu		63.3			491			35.5	
Fe		113			94			41.3	
Au		20.5			84			42.1	
Pb		36.5			65.5			98.3	
Ni		65.7			42.2			39.5	
Pd		86			48.5			115	
Pt		96.7			43			58	
Se		32.8			81.6			145	
Te		32.9			73.8			156	
Sn		25.0			62.3			124	
Zn		71.4			134			31.0	

RM Type Form (Block, Wire, Turnings) Unit Size (in g)	8162/8163/8164 Fine Silver			8165/8166/8167 Fine Silver			8168/8169/8170 Fine Silver			8171/8172/8173 Fine Silver		
	B	W*	T*	B	W*	T*	B	W*	T*	B	W*	T*
	30	25	25	30	25	25	30	25	25	30	25	25
Components (in mg/kg)												
Bi		65.3			83.5			28.9			75.1	
Cu		40.1			61.6			101			65.2	
Fe		25.0			35.6			15.4			48.9	
Au		52			15.0			75.0			26.7	
Pb		18.1			59.1			125			38.8	
Ni		27.4			35.0			13.5			57.0	
Pd		41.8			64.3			11.7			27.3	
Pt		17.3			17.9			24.4			12.3	
Se		55.8			32.2			3.9			44.4	
Te		62.9			(41.8)			6.6			25.8	
Sn		21.7			54.1			10.3			46.1	
Zn		(3.8)			18.6			8.3			7.2	

Values in parentheses are not certified and are given for information only.

* The Wire and Turnings forms are slated for future issue.

RM Type Form (Disc, Wire, Foil) Unit Size (in g)	8068/8069/8070 Gold Bullion			8071/8072/8073 Gold Bullion			8074/8075/8076 Gold Bullion			8077/8078/8079 Gold Bullion			8080/8081/8082 Gold Bullion		
	D	W	F	D	W	F	D	W	F	D	W	F	D	W	F
	30	25	25	30	25	25	30	25	25	30	25	25	30	25	25
Components (in Wt. %)															
Au		94.847			89.928			84.905			79.962			74.988	
Ag		4.15			8.03			12.08			15.09			15.04	
Cu		(1)			(2)			(3)			(5)			(10)	

Values in parentheses are not certified and are given for information only.

104. Royal Canadian Mint Reference Materials (solid forms) – Continued

RM Type Form (Block, Wire, Turnings) Unit Size (in g)	8050/8051/8052 Fine Gold			8053/8054/8055 Fine Gold			8056/8057/8058 Fine Gold			8059/8060/8061 Fine Gold			8062/8063/8064 Fine Gold			8065/8066/8067 Fine Gold		
	B	W	T	B	W	T	B	W	T	B	W	T	B	W	T	B	W	T
	30	25	25	30	25	25	30	25	25	30	25	25	30	25	25	30	25	25
Components (in mg/kg)																		
As		2.4			10.0			18.0			6.7			29.4			14.3	
Bi		3.4			24.0			34.0			6.8			53.9			11.0	
Cr		1.7			32.6			13.3			8.1			4.9			16.7	
Cu		1.6			98.1			46.9			5.7			9.8			13.8	
Fe		6.2			11.6			33.8			7.5			90.4			15.4	
Pb		1.9			21.9			30.5			6.4			49.7			11.5	
Mg		1.1			34.0			11.8			6.0			3.2			15.6	
Mn		1.1			58.9			22.5		10.8				64.3			20.5	
Ni		2.7			32.5			50.5		5.7				14.6			13.5	
Pd		1.3			43.1			19.8		5.0			119				13.1	
Pt					87.1			40.8		6.1				5.1			12.5	
Si					2.7			27.8		6.3				9.0			19.1	
Ag		9.5			20.3			81.7		7.1				49.7			15.1	
Sn		2.8			33.8			27.2		6.4				49.7			17.8	
Ti		0.7			12.7			25.3		5.9				2.6			16.5	
Zn		2.6			54.6			6.6		7.5				20.9			12.5	

104. Light Stable Isotopic Materials (gas, liquid and solid forms)

These RMs are for calibration of isotope-ratio mass spectrometers and associated sample preparation systems. They are distributed by NIST on behalf of the International Atomic Energy Agency (IAEA). Quantities of these materials are limited to *one (1) unit of each RM per laboratory every three (3) years*.

The isotopic compositions are given in parts per thousand (1000) difference from isotope-ratio standards—Vienna Standard Mean Ocean Water (VSMOW), Vienna PeeDee Belemnite (VPDB), atmospheric N₂ (Air), NBS28 Silica Sand (optical), and Canyon Diablo Troilite (CDT); with the exception of Lithium (Li), which is expressed as an absolute isotopic ratio.

RM	Type (IAEA Designation)	Unit Size	Nominal Isotopic Composition (in parts per 1000)						
			δD_{VSMOW}	${}^6Li/{}^7Li$	$\delta {}^{13}C_{VPDB}$	$\delta {}^{15}N_{Air}$	$\delta {}^{18}O_{VSMOW}$	$\delta {}^{30}Si_{NBS28}$	$\delta {}^{34}S_{CDT}$
8535	VSMOW–water	30 mL	0 *				0 *		
8536	GISP–water	30 mL	–190				–24.8		
8537	SLAP–water	30 mL	–428 *				–55.5 *		
8538	NBS30–biotite	2 g	–66				+5.1		
8539	NBS22–oil	1 mL	–120		–29.7				
8540	PEFI–polyethylene foil	x mg	–100		–31.8				
8541	USGS24–graphite	0.8 g			–16				
8542	Sucrose ANU–sucrose	1 g			–10.5				
8543	NBS18–carbonatite	0.4 g			–5.0		+7.2		
8544	NBS19–limestone	0.4 g			+1.95 *		+28.6		
8545	LSVEC–lithium carbonate	0.4 g		0.0832 [†]	–47		+3		
8546	NBS28–silica sand (optical)	0.4 g					+9.6	0 *	
8547	IAEA-N1–ammonium sulfate	0.4 g				+0.4			
8548	IAEA-N2–ammonium sulfate	0.4 g				+20.3			
8549	IAEA-N3–potassium nitrate	0.4 g				+2			
8550	USGS25–ammonium sulfate	0.5 g				–30.4			
8551	USGS26–ammonium sulfate	0.5 g				+53.5			
8552	NSVEC–gaseous nitrogen	300 μ mol				–2.8			
8553	Soufre de Lacq–elemental sulfur	0.5 g							+16
8554	NZ1–silver sulfide	0.5 g							–0.3
8555	NZ2–silver sulfide	0.5 g							+21
8556	NBS123–sphalerite	0.5 g							+17
8557	NBS127–barium sulfate	0.5 g					+9.3		+20
8558	USGS32–potassium nitrate	0.5 g				+179.9			

* Exactly defined isotopic abundances

[†] Absolute isotopic ratio

105. Health and Industrial Hygiene

Clinical Laboratory Materials (gas and solid forms)

These SRMs are for calibrating apparatus and validating analytical methods used in clinical and pathology laboratories. SRM 1400 Bone Ash and SRM 1486 Bone Meal are for use in determining selected major, minor, and trace elements in bone or similar matrices. SRM 2389 is for use in the chromatographic determination of amino acids.

SRM	Type	Purity/Constituent (in Wt. %)	Unit Size
900	Antiepilepsy Drug Level Assay (phenytoin, ethosuximide, phenobarbital, and primidone)		Set of 4 ampules
910	Sodium Pyruvate	98.7	25 g
911b	Cholesterol	99.8	2 g
912a	Urea	99.9	25 g
913	Uric Acid	99.7	10 g
914a	Creatinine	99.7	10 g
915a	Calcium Carbonate	99.9	20 g
916a	Bilirubin	98.3	100 mg
917a	D-Glucose (Dextrose)	99.7	25 g
918	Potassium Chloride	99.9	30 g
919a	Sodium Chloride	99.89	30 g
920	D-Mannitol	99.8	50 g
921	Cortisol (Hydrocortisone)	98.9	1 g
*924a	Lithium Carbonate	99.9	30 g
925	VMA (4-hydroxy-3-methoxymandelic acid)	99.4	1 g
928	Lead Nitrate	100.00	30 g
929	Magnesium Gluconate Dihydrate	Mg 5.403	5 g
937	Iron Metal (Clinical)	99.90	50 g
938	4-Nitrophenol	(99.75)	15 g
955a	Lead in Blood		Set of 4 ampules
*956a	Electrolytes in Serum for ISE	In Prep	Set of 9 ampules
968b	Fat Soluble Vitamins and Cholesterol in Human Serum	In Prep	Set of 6 ampules
998	Angiotensin I (Human)	94.1	0.5 mg
1400	Bone Ash	8 elements	50 g
1486	Bone Meal	8 elements	50 g
1595	Tripalmitin	99.5	2 g
1598	Inorganic Constituents in Bovine Serum		Set of 2 ampules
1599	Anticonvulsant Drug Level Assay (valproic acid and carbamazepine)		Set of 4 ampules
1951a	Cholesterol in Human Serum (Frozen)	In Prep	Set of 6 bottles
1952a	Cholesterol in Human Serum (Freeze-dried)		Set of 6 bottles
2389	Amino Acids in HCl	17 amino acids	Set of 5 ampules

Values in parentheses are not certified and are given for information only.

*Conforms to National Committee for Clinical Laboratory Standards (NCCLS) specification ACC-1.

105. Serum Materials

SRM 909a is a lyophilized human serum for use in determining specified constituents. SRM 927b, the bovine serum albumin is in solution form; SRM 965 is a frozen human serum certified for three (3) levels of glucose.

SRM	Type	Unit Size		Analyte Concentrations (in mmol/L)	
				909a-1	909a-2
909a	Human Serum	909a-1; 3 bottles 909a-2; 3 bottles	Calcium	2.322	3.338
			Chloride	92.4	119.1
			Cholesterol	4.892	4.463
			Creatinine	0.084	0.463
			Glucose	4.95	15.41
			Lithium	0.465	2.657
			Magnesium	0.868	1.846
			Potassium	3.656	6.21
			Sodium	148.5	126.5
			Urea	5.535	19.47
909b	Human Serum	In Prep	Uric Acid	0.234	0.525
927b	Bovine Serum Albumin	Set of 10 ampules	Peptide Mass	72.01 g/L	
965	Glucose in Frozen Human Serum			In Prep	

105. Ethanol Solutions

SRM	Type	Certified Constituent	Unit Size
1828a	Ethanol-Water	Ethanol	In Prep

105. Toxic Substances in Urine (powder form)

SRMs 2670, 2671a and 2672a are for determining toxic substances in human urine. They consist of freeze-dried urine, provided in sets of four 30-mL bottles—two each at low and elevated levels.

NOTE: The values listed for these SRMs apply only to reconstituted urine.

SRM	Type	Low/Elevated Elemental Composition (in mg/L)						
		Al	As	Be	Cd	Ca		
2670	Toxic Metals	(0.18)/(0.18)	(0.06)/0.48	(≤ 0.0005)/(0.033)	(0.00040)/0.088	0.105/0.105 g/L		
2671a	Fluoride							
2672a	Mercury							
SRM	Cl	Cr	Cu	F	Au	Pb	Mg	Mn
2670	(4.4)/(4.4) g/L	(0.013)/0.085	0.13/0.37		(0.008)*/(0.24)	(0.01)/0.109	0.063/0.063 g/L	(0.03)/(0.33)
2671a				0.55/5.7				
2672a								
SRM	Hg	Ni	Pt	K	Se	Na	V	SO ₄
2670	(0.002)/0.105	(0.07)/(0.30)	(0.008)*/(0.12)	(1.5)/(1.5) g/L	0.030/0.46	2.62/2.62 g/L	–/(0.12)	(1.3)/(1.3) g/L
2671a								
2672a	(0.002)/0.105							

Values in parentheses are not certified and are given for information only.

* Value is in µg/L.

105. Drugs of Abuse in Urine, Single Analyte (powder form)

These SRMs are for verifying the accuracy of methods used to determine marijuana, morphine glucuronide and cotinine, substances classed as drugs of abuse in humans or metabolites of drugs of abuse. SRMs 1507b and 2382 consist of freeze-dried urine, provided in sets of four 20-mL bottles—three levels plus a blank. RM 8444 consists of freeze-dried urine in a set of four 10-mL vials—two levels and two blanks. Each SRM/RM consists of a single analyte drug of abuse.

SRM/RM	Type	Unit Size	Component (in µg/L)			
			I Blank	II Low	III Medium	IV High
1507b	THC-9-COOH	Set of 4 bottles	x _D : < 1	11.7	24.1	49.6
2382	Morphine Glucuronide	Set of 4 bottles	x _D : < 1	209	437	853
8444	Cotinine	Set of 4 vials	0.8	54		488

105. Drugs of Abuse in Urine, Multi-Analyte (powder form)

These SRMs are for verifying the accuracy of methods used to determine cocaine, morphine and codeine and opiate-based substances classed as drugs of abuse in humans. Each SRM consists of multi-analyte drugs of abuse. SRMs 1508 and 2381 consist of freeze-dried urine, provided in sets of four 20-mL bottles—three levels plus a blank. SRM 1511 consists of a mixture of five substances—morphine, codeine, cocaine metabolite, marijuana metabolite and phencyclidine in freeze-dried urine and is provided as a set of three bottles, each containing all analytes (no blank).

SRM	Type	Unit Size	Component (in µg/L)					
			Cocaine	Benzoyl-ecgonine	Morphine	Codeine	THC-9-COOH	Phen-cyclidine
1508	Cocaine and Metabolites	Set of 4 bottles	90-429	103-510				
1511	Multi-drugs of Abuse	Set of 3 bottles		162	309	288	14.1	23.8
2381	Morphine and Codeine	Set of 4 bottles			134-580	130-560		

105. Drugs of Abuse in Hair (solid forms)

These SRMs were developed primarily to further research related to the accurate determination of drugs of abuse in human hair. The values provided on the Reports of Investigation are not certified. Rather they are "Best Estimates" based on proven NIST methods.

RM	Type	Unit Size (in mg)	Component (in mg/kg)			
			Cocaine	Benzoyl-ecgonine	Morphine	Codeine
8448	Human Hair Segments	110-125	7.3	1.6	11.9	6.7
8449	Powdered Human Hair	100-120	7.0	4.0	4.3	2.9

105. DNA Profiling (solid forms)

These SRMs are intended for use in the standardization of forensic and paternity quality assurance procedures and instructional law enforcement or non-clinical research purposes. SRM 2390 DNA Profiling Standard, based on Restriction Fragment Length Polymorphism (RFLP) testing, is certified for the sizes of each allelic band of five commonly used DNA probes of two human DNA samples; one is from a female cell line, and the other is from a male source. SRM 2391 [Polymerase Chain Reaction] PCR-Based DNA Profiling Standard is certified for allele assignment of D1S80 loci for eight human DNA samples plus two human cell lines. Both SRMs consist of 20 components. SRM 2392 DNA Standard for Mitochondrial Sequencing is currently under development. It will consist of a molecular tag with 108 basepairs and a DNA sequence that translates from the triplet nucleotide code to the single amino acid letter code and spells: **NIST*DNA*STANDARD*REFERENCE*MATERIAL**.

SRM	Type	Unit of Issue
2390	DNA Profiling	20 components: boxes A, B, and C
2391	PCR-Based DNA Profiling	20 components: boxes A and B
2392	DNA Mitochondrial Sequencing	In Prep

105. Materials on Filter Media

These SRMs consist of potentially hazardous materials deposited on filters to be used to determine the levels of these materials in industrial atmospheres. SRMs 2672d, 2677a and 2679a provide element values at four different levels; SRM 3087 provides element values at one level only.

SRM	Type	Unit Size	Element/Component (in µg/filter)				
				I	II	III	IV
2676d	Metals on Filter Media	Set of 6	Cadmium	0.97	2.81	10.04	(<0.0005)
			Lead	7.44	14.82	29.77	(<0.0005)
			Manganese	2.09	9.83	19.83	(<0.0005)
			Zinc	10.17	49.47	99.31	(0.26)
2677a	Beryllium and Arsenic on Filter Media	2 Sets of 5	Beryllium	0.129	0.643	2.58	0.050
			Arsenic	0.269	2.69	26.92	≤ 0.0005 Blank 0.101 ≤ 0.0005 Blank
2679a	Quartz on Filter Media	Set of 4	Quartz Clay	≤ 2 (370)	30.8 (370)	80.2 (370)	202.7 (370)
3087	Metals on Filter Media	Set of 6 and 5 blanks	Barium		25.88		
			Cadmium		15.50		
			Chromium		10.33		
			Iron		25.84		
			Magnesium		25.83		
			Nickel		25.86		
			Lead		41.33		
			Selenium		25.84		
			Zinc		103.3		

Values in parentheses are not certified and are given for information only.

105. Trace Constituent Elements in Blank Filters

SRMs 2678 and 2681 are for use in evaluating the performance of air sampling filter methods with two different filter types or sizes commonly used in air sampling of industrial atmospheres. For both SRMs, either certified values (in µg), or limits of detection (X_D), for each of 30 constituent elements as well as 6 leachable anions and cations are provided.

SRM	Type	Diameter (in mm)	Pore Size (in µm)	Filter Weight (in g)
2678	Cellulose Acetate Membrane	47	0.45	0.09
2681	Ashless	42.5		0.14

105. Respirable Silica (powder form)

SRMs 1878a, 1879 and 1879a are crystalline silica materials with particles in the respirable range. They are intended for use in determining by X-ray diffraction, the levels of respirable silica in an industrial atmosphere according to NIOSH Analytical Method P&CAM 259 or equivalent methods.

Note: These SRMs are not certified for particle size.

SRM	Type	Unit Size	Component (in Wt. %)
1878a	Respirable Alpha Quartz	5 g	In Prep
1879	Respirable Cristobalite	5 g	Crystalline Cristobalite, 98.0
1879a	Respirable Cristobalite	5 g	In Prep

105. Lead in Paint (powder and sheet forms)

These SRMs are for use in determining lead in paint matrices. SRM 1579a consists of paint, obtained from old housing, that has been ground and homogenized into a powder, 99+ % of which passes a 45 μm sieve. SRM 2579 consists of a set of five mylar sheets; four are coated with a single, uniform paint layer, the fifth sheet is a blank. SRM 2582 is a latex paint that has been ground and homogenized to pass a 100 μm sieve. SRMs 2580 and 2581 are intended to provide lead levels of approximately 5% and 0.5% respectively.

SRM	Type	Unit Size	Lead Concentration
1579a	Powdered Lead Base Paint	35 g	11.995 Wt.%
2579	Lead Paint Film	5 ea: 7.6 cm $\times$ 10.2 cm	3.53 to <0.0001 mg/cm ³
2580	Powdered Paint		In Prep
2581	Powdered Paint		In Prep
2582	Powdered Paint (Low Lead)	20 g	209 mg/kg

105. Asbestos

These SRMs are for use in identifying and quantifying asbestos types. SRM 1866a consists of a set of three common bulk mine-grade asbestos materials; chrysotile, grunerite (Amosite), riebeckite (Crocidolite), and one glass fiber sample. SRM 1867 consists of a set of three uncommon mine-grade asbestos materials; antophyllite, tremolite, and actinolite. The optical properties of SRMs 1866a and 1867 as observed by polarized light microscopy (PLM), have been characterized so that they may serve as primary calibration standards for the identification of asbestos types in building materials.

SRM 1868 consists of a set of two common bulk mine-grade asbestos materials; chrysotile and grunerite (Amosite), contained in matrices simulating building materials (calcium carbonate and glass fiber), in quantities at just below the U.S. EPA regulatory limit of 1%. This SRM is certified by weight for the quantity of each asbestos material present.

SRM 1876b is intended for use in evaluating the techniques used to identify and count chrysotile asbestos fibers by transmission electron microscopy (TEM). A unit consists of sections of mixed-cellulose-ester filters containing chrysotile asbestos fibers deposited by an aerosol generator.

SRM 8411 consists of a section of collapsed mixed-cellulose-ester filters with a high concentration (138 fibers/0.01 mm²) of chrysotile asbestos and a medium concentration (43 fibers/0.01 mm²) of grunerite (Amosite) asbestos. It is intended for use in evaluating the techniques used to identify and count asbestos fibers by transmission electron microscopy (TEM).

SRM	Type	Unit Size
1866a	Common Commercial Asbestos	Set of 3: 4 g each
1867	Uncommon Commercial Asbestos	Set of 3: 5 to 10 g each
1868	Quantitative Asbestos in Building Materials	Set of 2: 5 to 10 g each
1876b	Chrysotile Asbestos for TEM	Set of 10: 3 mm $\times$ 3 mm
8411	Mixed Asbestos Research Filter	1 cm ²

106. Inorganics

106. Metal Constituents in Water and Sediments (liquid and solid forms)

These SRMs are for analysis of materials of health or environmental interest.

SRM/RM	Type	Unit Size	Elemental Composition
1640	Natural Water	250 mL	In Prep
1641c	Mercury in Water	6 × 20 mL	Hg: 1.47 mg/L
1643d	Trace Elements in Water	250 mL	In Prep
1646a	Estuarine Sediment	75 g	20 elements certified (see Category 111)
2704	Buffalo River Sediment	50 g	25 elements certified (see Category 111)

106. Simulated Rainwaters (liquid form)

This SRM was developed to aid in the analysis of acidic rainwater by providing a stable, homogeneous material at two levels of acidity.

SRM	Type	Unit Size	
2694a	Simulated Rainwater	Set of 4: 2 of 50 mL at each of 2 levels	
Constituent Element/Parameter		2694a-I	2694a-II
pH, 25 °C		4.30	3.60
Electrolytic Conductivity (μS/cm, 25 °C)		25.4	129.3
Acidity, meq/L		0.0544	0.283
Fluoride, mg/L		0.057	0.108
Chloride, mg/L		(0.23)	(0.94)
Nitrate, mg/L		(0.53)	7.19
Sulfate, mg/L		2.69	10.6
Sodium, mg/L		0.208	0.423
Potassium, mg/L		0.056	0.108
Ammonium, mg/L		(0.12)	(1.06)
Calcium, mg/L		0.0126	0.0364
Magnesium, mg/L		0.0242	0.0484

Values in parentheses are not certified and are given for information only.

106. Thin Films for X-ray Fluorescence

These SRMs are for standardizing X-ray spectrometers. They may be useful in elemental analysis of particulate matter collected on filter media, and where X-ray spectrometer calibration functions are determined using thin film standards. Each SRM is individually certified and consists of a silica base glass film (0.5 μm thick) deposited on a 47-mm diameter polycarbonate filter mounted on an aluminum ring.

SRM	Type	Elemental Composition per area (in μg/cm ²)											
		Al	Ca	Co	Cu	Fe	Pb	K	Mn	Si	Ti	V	Zn
1832	Thin-Glass Film	15	20	1	2				5	36		5	
1833	Thin-Glass Film					15	17	18		35	14		4

106. Carbon Modified Silicon (powder form)

This SRM is intended for the calibration of instruments used to measure total elemental carbon. The SRM consists of three (3), 1-g bottles of chemically modified microparticulate silica.

SRM	Type	Bottle	% Carbon
1216	Carbon Modified Silicon	I	0.7
		II	9.06
		III	17.04

106. Trace Elements (liquid and solid forms)

This SRM is for analysis of trace elements in materials of environmental interest.

SRM	Type	Unit	Size	Trace Elements (in mg/kg* unless noted as Wt.%)				
				Al	Sb	As	Ba	
1648	Urban Particulate Matter	2 g		3.42 Wt.%	(45)	115	(737)	
SRM	Br	Cd	Ce	Cs	Cl	Cr	Co	Cu
1648	(500)	75	(55)	(3)	(0.45 Wt.%)	403	(18)	609
SRM	Hf	In	I	Fe	La	Pb	Mn	Ni
1648	(4.4)	(1.0)	(20)	3.91 Wt.%	(42)	0.655 Wt.%	(860)	82
SRM	K	Se	Na	Th	U	V	Zn	
1648	1.05 Wt.%	27	0.425 Wt.%	(7.4)	5.5	140	0.476 Wt.%	

Values in parentheses are not certified and are given for information only.

* SI unit. Replaces "ppm" and "µg/g".

106. Used Auto Catalysts (powder form)

These SRMs are intended for use in the evaluation of methods for the analysis of the platinum group metals and lead in auto catalysts. They were produced in cooperation with the International Precious Metals Institute and are issued as fine (<74 µm) powders.

SRM	Type	Unit Size	Elemental Composition (in mg/kg)			
			Pt	Pd	Rh	Pb
2556	Recycled Pellet	70 g	697.4	326.0	51.2	6228
2557	Recycled Monolith	70 g	1131	233.2	135.1	13931

107. Analyzed Gases

Mixtures and Pollutants

These SRMs are for calibrating apparatus used to measure various components of gas mixtures and atmospheric pollutants. All cylinders conform to the appropriate DOT specifications.

SRM	Type	Certified Component	Nominal Concentration (in $\mu\text{mol/mol}$)
1811	Aromatic Organic Gases in Nitrogen		
	Benzene	C_6H_6	0.25
	Toluene	$\text{C}_6\text{H}_5\text{CH}_3$	0.25
	Chlorobenzene	$\text{C}_6\text{H}_5\text{Cl}$	0.25
	Bromobenzene	$\text{C}_6\text{H}_5\text{Br}$	0.25
1812	Aromatic Organic Gases in Nitrogen		
	Benzene	C_6H_6	10
	Toluene	$\text{C}_6\text{H}_5\text{CH}_3$	10
	Chlorobenzene	$\text{C}_6\text{H}_5\text{Cl}$	10
	Bromobenzene	$\text{C}_6\text{H}_5\text{Br}$	10
1700a	Blood Gas: CO_2 -10%, Bal N_2	CO_2 in N_2	10 mol % CO_2
1701a	Blood Gas: CO_2 -5%, O_2 -12%, Bal N_2	CO_2 & O_2 in N_2	5 mol % CO_2 12 mol % O_2
1702a	Blood Gas: CO_2 -5%, O_2 -20%, Bal N_2	CO_2 & O_2 in N_2	5 mol % CO_2 20 mol % O_2
1703a	Blood Gas: CO_2 -10%, O_2 -7%, Bal N_2	CO_2 & O_2 in N_2	10 mol % CO_2 7 mol % O_2
2607	Carbon Dioxide and Nitrous Oxide in Air		
	Carbon Dioxide	CO_2	340
	Nitrous Oxide	N_2O	0.3
2609	Carbon Dioxide and Nitrous Oxide in Air		
	Carbon Dioxide	CO_2	380
	Nitrous Oxide	N_2O	0.33
2610	Carbon Dioxide and Nitrous Oxide in Air		
	Carbon Dioxide	CO_2	380
	Nitrous Oxide	N_2O	0.33
1674b	Carbon Dioxide in Nitrogen	CO_2	7 mol %
1675b	Carbon Dioxide in Nitrogen	CO_2	14 mol %
2619a	Carbon Dioxide in Nitrogen	CO_2	0.5 mol %
2620a	Carbon Dioxide in Nitrogen	CO_2	1.0 mol %
2621a	Carbon Dioxide in Nitrogen	CO_2	1.5 mol %
2622a	Carbon Dioxide in Nitrogen	CO_2	2.0 mol %
2623a	Carbon Dioxide in Nitrogen	CO_2	2.5 mol %
2624a	Carbon Dioxide in Nitrogen	CO_2	3.0 mol %
2625a	Carbon Dioxide in Nitrogen	CO_2	3.5 mol %
2626a	Carbon Dioxide in Nitrogen	CO_2	4.0 mol %
2632a	Carbon Dioxide in Nitrogen	CO_2	300
2612a	Carbon Monoxide in Air	CO	10
2613a	Carbon Monoxide in Air	CO	20
2614a	Carbon Monoxide in Air	CO	45

107. Mixtures and Pollutants – Continued

SRM	Type	Certified Component	Nominal Concentration (in $\mu\text{mol/mol}$)
1677c	Carbon Monoxide in Nitrogen	CO	10
1678c	Carbon Monoxide in Nitrogen	CO	50
1679c	Carbon Monoxide in Nitrogen	CO	100
1680b	Carbon Monoxide in Nitrogen	CO	500
1681b	Carbon Monoxide in Nitrogen	CO	1000
2635a	Carbon Monoxide in Nitrogen	CO	25
2636a	Carbon Monoxide in Nitrogen	CO	250
2637a	Carbon Monoxide in Nitrogen	CO	2500
2638a	Carbon Monoxide in Nitrogen	CO	5000
2639a	Carbon Monoxide in Nitrogen	CO	1 mol %
2640a	Carbon Monoxide in Nitrogen	CO	2 mol %
2641a	Carbon Monoxide in Nitrogen	CO	4 mol %
2642a	Carbon Monoxide in Nitrogen	CO	8 mol %
2740	Carbon Monoxide in Nitrogen	CO	10 mol %
2741	Carbon Monoxide in Nitrogen	CO	13 mol %
2745	Carbon Monoxide in Nitrogen	CO	16 mol %
2727	Carbon Monoxide, Propane and Carbon Dioxide in Nitrogen	CO C ₃ H ₈	1.6 mol % 600
2728	Carbon Monoxide, Propane and Carbon Dioxide in Nitrogen	CO ₂ CO C ₃ H ₈ CO ₂	11 mol % 8 mol % 3000 14 mol %
1658a	Methane in Air	CH ₄	1
1659a	Methane in Air	CH ₄	10
1660a	Methane-Propane in Air	CH ₄ C ₃ H ₈	4 1
2750	Methane in Nitrogen	CH ₄	50
2751	Methane in Nitrogen	CH ₄	100
1683b	Nitric Oxide in Nitrogen	NO	50
1684b	Nitric Oxide in Nitrogen	NO	100
1685b	Nitric Oxide in Nitrogen	NO	250
1686b	Nitric Oxide in Nitrogen	NO	500
1687b	Nitric Oxide in Nitrogen	NO	1000
2627a	Nitric Oxide in Nitrogen	NO	5
2628a	Nitric Oxide in Nitrogen	NO	10
2629a	Nitric Oxide in Nitrogen	NO	20
2630	Nitric Oxide in Nitrogen	NO	1500
2631	Nitric Oxide in Nitrogen	NO	3000
2735	Nitric Oxide in Nitrogen	NO	800
2736	Nitric Oxide in Nitrogen	NO	2000
2656	Oxides of Nitrogen in Air	NO _x	2500
2660	Oxides of Nitrogen in Air	NO _x	100
2657a	Oxygen in Nitrogen	O ₂	2 mol %
2658a	Oxygen in Nitrogen	O ₂	10 mol %
2659a	Oxygen in Nitrogen	O ₂	21 mol %
1665b	Propane in Air	C ₃ H ₈	3
1666b	Propane in Air	C ₃ H ₈	10
1667b	Propane in Air	C ₃ H ₈	50
1668b	Propane in Air	C ₃ H ₈	100
1669b	Propane in Air	C ₃ H ₈	500
2764	Propane in Air	C ₃ H ₈	0.25
1670a	Carbon Dioxide in Air	CO ₂	330
1671a	Carbon Dioxide in Air	CO ₂	340
1672a	Carbon Dioxide in Air	CO ₂	350

107. Mixtures and Pollutants – Continued

SRM	Type	Certified Component	Nominal Concentration (in $\mu\text{mol/mol}$)
2643a	Propane in Nitrogen	C_3H_8	100
2644a	Propane in Nitrogen	C_3H_8	250
2645a	Propane in Nitrogen	C_3H_8	500
2646a	Propane in Nitrogen	C_3H_8	1000
2647a	Propane in Nitrogen	C_3H_8	2500
2648a	Propane in Nitrogen	C_3H_8	5000
2649a	Propane in Nitrogen	C_3H_8	1 mol %
2650	Propane in Nitrogen	C_3H_8	2 mol %
2651	Propane in Nitrogen and Oxygen	C_3H_8 O_2	0.01 mol % 5.0 mol %
2652	Propane in Nitrogen and Oxygen	C_3H_8 O_2	100 10.0 mol %
1661a	Sulfur Dioxide in Nitrogen	SO_2	500
1662a	Sulfur Dioxide in Nitrogen	SO_2	1000
1663a	Sulfur Dioxide in Nitrogen	SO_2	1500
1664a	Sulfur Dioxide in Nitrogen	SO_2	2500
1693a	Sulfur Dioxide in Nitrogen	SO_2	50
1694a	Sulfur Dioxide in Nitrogen	SO_2	100
1696a	Sulfur Dioxide in Nitrogen	SO_2	3500
1800	Ambient Non-methane Organics in Nitrogen	(Fifteen components)	5.0 nmol/mol
1804a	Ambient Toxic Organics in Nitrogen	(Nineteen components)	
2730	Hydrogen Sulfide in Nitrogen	H_2S	5
2731	Hydrogen Sulfide in Nitrogen	H_2S	20

107. Permeation Devices

These SRMs are primarily intended for use in calibrating air pollution monitoring apparatus and for calibrating air pollution analytical methods and procedures. Each tube is individually calibrated and certified according to NIST procedures and protocols.

SRM	Type	Tube Length (in cm)	Permeation Rate at 30 °C (in $\mu\text{g/min}$)	Concentration* (in $\mu\text{mol/mol}$) @ Flow Rate (L/min) of		
				1	5	10
1625	Sulfur Dioxide Permeation Tube	10	3.7		In Prep	
1626	Sulfur Dioxide Permeation Tube	5	2.1		In Prep	
1627	Sulfur Dioxide Permeation Tube	2	0.8	0.3	0.06	0.03
1629a	Nitrogen Dioxide Permeation Tube	1	2.1		In Prep	

* Nominal values

108. Fossil Fuels

Alcohols and Ethers [Oxygenates] in Reference Fuels (liquid form)

SRMs 1829, 1837, 1838, and 1839 are for calibrating instruments and validating methods used to determine various alcohols in gasoline. SRM 1829 is issued as a set of six (6) sealed 20-mL ampules; SRMs 1837, 1838 and 1839 are each issued as a set of five (5) sealed 20-mL ampules.

SRMs 2286 through 2293 are for determining the oxygen content of gasoline and were produced in response to the U.S. EPA Final Rule on Reformulated Gasoline aimed at reducing the volatile organic compounds emitted from gasoline. They consist of varying quantities of alcohol and ether (oxygenate) solutions in gasoline and are certified for constituent oxygenate concentration and resultant oxygen concentration in gasoline. Each SRM is issued as a set of three (3) sealed 20-mL ampules—two ampules contain oxygenate and one ampule contains base reference gasoline.

SRM	Type	Concentration (in Wt. %)				
		Methanol	Ethanol	Methanol and t-Butanol	Oxygenate	Oxygen
1829	Alcohols in Reference Fuels	0.335	11.39	10.33 + 6.63		
1837	Methanol and t-Butanol			10.33 + 6.63		
1838	Ethanol		11.39			
1839	Methanol	0.335				
2286	Ethanol in Gasoline				5.73	2.02
2287	Ethanol in Gasoline				10.07	3.53
2288	t-Amyl Methyl Ether in Gasoline				12.78	2.02
2289	t-Amyl Methyl Ether in Gasoline				17.30	2.73
2290	Ethyl t-Butyl Ether in Gasoline				12.78	2.01
2291	Ethyl t-Butyl Ether in Gasoline				17.18	2.70
2292	Methyl t-Butyl Ether in Gasoline				10.96	2.00
2293	Methyl t-Butyl Ether in Gasoline				14.86	2.71

108. Metal Constituents in Fossil Fuels (liquid and solid forms)

These SRMs are for analysis of metal trace elements in fuel oil, coal and reference fuels.

SRM/RM	Type	Unit Size	Elemental Composition			
			Pb	Ni	S	V
Nominal Composition [In Wt.% unless identified by an asterisk which indicates mg/kg.]						
1618	Vanadium and Nickel in Residual Fuel Oil	100 mL		75 *	(4.3)	423 *
2712	Lead in Reference Fuel	6 × 20 mL	11.4 *			
2713	Lead in Reference Fuel	6 × 20 mL	19.4 *			
2714	Lead in Reference Fuel	6 × 20 mL	28.1 *			
2715	Lead in Reference Fuel	6 × 20 mL	784 *			
8505	Vanadium in Crude Oil	250 mL				(390 *)

108. Sulfur in Fossil Fuels (liquid and solid forms)

SRM/RM	Type	Unit Size	Sulfur (in Wt. %)	Furnace Ash (in Wt. %)	HHV2 (in MJ/kg)
1616a	Sulfur in Kerosine	100 mL	In Prep		
1617a	Sulfur in Kerosine	100 mL	In Prep		
1619a	Sulfur in Residual Fuel Oil	100 mL	0.725		
1620b	Sulfur in Residual Fuel Oil	100 mL	4.22		
1621d	Sulfur in Residual Fuel Oil	100 mL	1.011		
1622d	Sulfur in Residual Fuel Oil	100 mL	2.031		
1623b	Sulfur in Residual Fuel Oil	100 mL	0.348		
1624b	Sulfur in Distillate Fuel Oil	100 mL	0.332		
2717	Sulfur in Residual Fuel Oil	100 mL	3.022		
2724	Sulfur in Diesel Fuel Oil	100 mL	0.0425		
8532	Diesel Fuel Oil	100 mL (S = 276/294 g/kg)		Gravity * (36.9)	
2682a	Coal (Sub-bituminous)	50 g	0.486	6.3	25.48
2683a	Coal (Bituminous)	50 g	1.89	6.8	31.90
2684a	Coal (Bituminous)	50 g	3.06	11.0	28.50
2685a	Coal (Bituminous)	50 g	4.730	16.21	26.67
2692a	Sulfur in Coal, 1%	50 g	1.184	7.94	32.64
2775	Foundry Coke	In Prep			
2776	Furnace Coke	In Prep			

NOTE: The calorific values (MJ/kg) may decrease upon the aging or normal oxidation of the coals. NIST will continue to monitor these values and report any substantive change to purchasers.

* API Gravity at 15.6 °C. Total nitrogen aromatics and PAHs also available.

108. Moisture in Oils (liquid form)

These reference materials (RMs) are intended for use in developing and validating methods for the determination of moisture in oil and similar matrices. The water concentration values are shown in parentheses because they are not certified, but represent the "best estimate" of the moisture content based on inter-laboratory round robin studies and confirmed by NIST.

RM	Type	Unit Size	Water Concentration (in mg/kg)
8506	Transformer Oil	Set of 5 ampules: (10 mL each)	(21)
8507	Mineral Oil	Set of 5 ampules: (10 mL each)	(47)

Values in parentheses are not certified and are given for information only.

108. Reference Liquids for Evaluating Fuels

SRMs 1815a and 1816a are high, purity liquids intended for use in maintaining the integrity of the octane rating of motor and aviation fuels as specified in the ASTM Manual for Rating Motor, Diesel, and Aviation Fuels.

SRM	Type	Purity (in Wt. %)	Unit Size
1815a	n-Heptane	99.987	100 mL
1816a	Iso octane (2,2,4-Trimethylpentane)	99.987	100 mL

108. Trace Elements (solid form)

SRM	1632b	1633b	1634c	1635	2689	2690	2691
Type	Coal (Bituminous)	Coal Fly Ash	Fuel Oil	Coal (Subbitum- inous)	Coal Fly Ash	Coal Fly Ash	Coal Fly Ash
Unit Size	50 g	75 g	100 mL	75 g	3×10 g	3×10 g	3×10 g
ELEMENT Concentrations are in mg/kg, unless noted by a single asterisk, *, for Wt. %, or a double asterisk, **, for µg/kg.							
Aluminum	0.855 *	15.05 *	In Prep	(0.32 *)	12.94 *	12.35 *	9.81 *
Antimony	(0.24)	(6)		(0.14)	(9)	(6)	(3)
Arsenic	3.72	136.2		0.42	(200)	(26)	(30)
Barium	67.5	709			(800)	(5800)	(5900)
Beryllium					(21)	(8)	(8)
Bromine	(17)	(2.9)					
Cadmium	0.0573	0.784		0.03	(3)	(0.7)	(0.9)
Calcium	0.204 *	1.51 *			2.18 *	5.71 *	18.45 *
Carbon	78.11 *						
Cerium	(9)	(190)		(3.6)			
Cesium	(0.44)	(11)			(11)	(8)	(1)
Chlorine	(1260)						
Chromium	(11)	198.2		2.5	(170)	(67)	(68)
Cobalt	2.29	(50)		(0.65)	(48)	(19)	(26)
Copper	6.28	112.8		3.6			
Dysprosium		(17)					
Europium	(0.17)	(4.1)		(0.06)	(3)	(2)	(2)
Gadolinium		(13)					
Gallium				(1.05)			
Hafnium	(0.43)	(6.8)		(0.29)	(7)	(8)	(10)
Holmium		(3.5)					
Hydrogen	5.07 *						
Iron (Total)	0.759 *	7.78 *		0.239 *	9.32 *	3.57 *	4.42 *
Lanthanum	(5.1)	(94)					
Lead	3.67	68.2		1.9	(52)	(39)	(29)
Lithium	(10)						
Lutetium		(1.2)					
Magnesium	0.0383 *	0.482 *			0.61 *	1.53 *	3.12 *
Manganese	12.4	131.8		21.4	(300)	(300)	(200)
Mercury		0.141			(< 0.003)	(< 0.003)	(< 0.003)
Molybdenum	(0.9)	(85)					
Neodymium		120.6					
Nickel	6.10	10.26		1.74	(122)	(46)	(53)
Nitrogen	1.56 *						
Phosphorus		(2300)			0.10 *	0.52 *	0.51 *
Potassium	0.0748 *	1.95 *			2.20 *	1.04 *	0.34 *
Rubidium	5.50	(140)					
Samarium	(0.87)	(20)					
Scandium	(1.9)	(41)		(0.63)	(32)	(17)	(24)
Selenium	1.29	10.26		0.9	(7)	(0.8)	(17)
Silicon	(1.4 *)	23.02 *			24.06 *	25.85 *	16.83 *
Sodium	0.0515 *	0.201 *		(0.24 *)	0.25 *	0.24 *	1.09 *
Strontium	(102)	1041			(700)	(2000)	(2700)
Sulfur	1.89 *	0.2075 *		0.33 *		0.15 *	0.83 *
Tantalum		(1.8)					
Terbium		(2.6)					
Thallium		(5.9)					
Thorium	1.342	25.7		0.62	(25)	(25)	(26)
Thulium		(2.1)					
Titanium	0.0454 *	0.791 *		(0.02 *)	0.75 *	0.52 *	0.90 *
Tungsten	(0.48)	(5.6)					
Uranium	0.436	8.79		0.24			
Vanadium	(14)	295.7		5.2			
Ytterbium		(7.6)					
Zinc	11.89	(210)		4.7	(240)	(120)	(120)

Values in parentheses are not certified and are given for information only.

109. Organics

109. GC/MS and LC System Performance (liquid form)

These SRMs and RMs are for evaluating the sensitivity of gas chromatography/mass spectrometry (GC/MS) instrumentation and for characterizing liquid chromatography (LC) column selectivity.

SRM/RM	Type	Unit Size	Selectivity (C18 phases)	Concentration (in mg/L) Low/High
869 8442	LC Selectivity	Set of 5, 1.1 mL Set of 50, 1.1 mL	BaP ≤ PhPh < TBN	
1543 8443	GC/MS System Performance	Set of 4, 1 mL Set of 20, 1 mL		Methyl Stearate 0.99/4.98 Benzophenone 1.01/5.01

109. Organic Constituents (liquid and solid forms)

These SRMs and RMs are further described in the following five pages.

SRM/RM	Type	Unit of Issue
1491	Aromatic Hydrocarbons in Hexane/Toluene	Set: 5, 1.2 mL/ampule
1492	Chlorinated Pesticides in Hexane	Set: 5, 1.2 mL/ampule
1493	Polychlorinated Biphenyl Congeners in <i>Iso</i> octane	Set: 5, 1.2 mL/ampule
1580	Shale Oil	Set: 5, 1.2 mL/ampule
1581	Polychlorinated Biphenyls in Oil	Set: 8, 2.5 mL/ampule
1582	Petroleum Crude Oil	Set: 5, 1.2 mL/ampule
1583	Chlorinated Pesticides in <i>Iso</i> octane	Set: 6, 1.2 mL/ampule
1584	Phenols in Methanol	Set: 5, 1.2 mL/ampule
1585	Chlorinated Biphenyls	Set: 5, 1.2 mL/ampule
1586	Isotopically Labelled Priority Pollutants	Set: 6, 1.2 mL/ampule
1587	Nitro PAH in Methanol	Set: 4, 1 mL/ampule
1588	Organics in Cod Liver Oil	Set: 5, 1.2 mL/ampule
1589	Polychlorinated Biphenyls (as Aroclor 1260) in Human Serum	Set: 3, 2 g/ampule
1596	Dinitropyrene Isomers and 1-Nitropyrene in Methylene Chloride	Set: 5, 1.3 mL/ampule
1597	Complex Mixture of Polycyclic Aromatic Hydrocarbons	Set: 4, 1.2 mL/ampule
1614	Dioxin (2,3,7,8 TCDD) in <i>Iso</i> octane	Set: 6, 1.2 mL/ampule
1639	Halocarbons (in Methanol)	Set: 5, 1.5 mL/ampule
1647c	Priority Pollutant Polycyclic Aromatic Hydrocarbons (in Acetonitrile)	Set: 5, 1.2 mL/ampule
1649	Urban Dust/Organics	5 g, bottle
1650	Diesel Particulate Matter	0.5 g, bottle
1939	Polychlorinated Biphenyls in River Sediment A	50 g, bottle
1941a	Organics in Marine Sediment	50 g, bottle
1945	Organics in Whale Blubber	Set: 2, 15 g/bottle
1974a	Organics in Mussel Tissue	In Prep
2260	Aromatic Hydrocarbons in Toluene	Set: 5, 1.2 mL/ampule
2261	Chlorinated Pesticides in Hexane	Set: 5, 1.2 mL/ampule
2262	Chlorinated Biphenyl Congeners in <i>Iso</i> octane	Set: 5, 1.2 mL/ampule
8464	Aldrin (neat)	In Prep
8465	Dieldrin (neat)	In Prep
8466	γ-HCH (Lindane) (neat)	Vial, 100 mg
8467	4,4'-DDE (neat)	Vial, 100 mg
8468	Heptachlor (neat)	In Prep
8469	4,4'-DDT (neat)	Vial, 100 mg

109. Organic Constituents (liquid and solid forms) – Continued

SRM	1491	1580	1582	1597	1647c	1649	1650	2260
Component (in mg/kg* except for SRM 1597 which is in mg/L)								
Anthracene	11.69			87.4	1.02			57.54
Benz[<i>a</i>]anthracene	5.37		3.0	85.3	5.24	2.6	6.5	66.0
Benzo[<i>a</i>]pyrene	10.14	21	1.1	82.9	6.32	2.9	1.2	68.61
Benzo[<i>e</i>]pyrene	8.40	18					(9.6)	75.98
Fluoranthene	8.84	54	2.5	278	9.82	7.1	51	76.31
o-Cresol		385						
Phenol		407						
Perylene	10.65	3.4	31	22.6			(0.13)	57.48
Pyrene	8.81	104		204	10.94		48	76.20
2,6-Dimethylphenol		175						
Benzo[<i>f</i>]quinoline (5,6-Benzoquinoline)		16						
Naphthalene	10.30			1000	25.62			76.3
Acenaphthylene	10.40				19.81			73.09
Acenaphthene	10.89				26.38			78.9
1-Nitropyrene							19	
Fluorene	10.87				6.10			75.62
Phenanthrene	10.48		101	400	4.46		(71)	76.01
Chrysene	10.50			62.0	4.75		(22)	76.6
Benzo[<i>b</i>]fluoranthene	7.85				5.37			75.97
Benzo[<i>k</i>]fluoranthene	8.33				6.01		(2.1)	75.67
Benzo[<i>ghi</i>]perylene	7.90			46.5	4.73	4.5	2.4	67.9
Dibenz[<i>a,h</i>]anthracene	7.74				4.62			67.1
Indeno[1,2,3- <i>cd</i>]pyrene	9.40			52.1	5.53	3.3	(2.3)	67.4
Dibenzothiophene			33					
Triphenylene				10.5				
1-Methylnaphthalene	12.4							75.7
2-Methylnaphthalene	(11.8)							(73.2)
Biphenyl	10.46							76.14
2,6-Dimethylnaphthalene	10.8							75.9
2,3,5-Trimethylnaphthalene	9.9							67.5
1-Methylphenanthrene	10.4							75.2

SRM 1492 Chlorinated Pesticides in Hexane

Pesticide	Concentration (in µg/kg)
Hexachlorobenzene	308
γ-HCH (Lindane)	310
Heptachlor	299
Aldrin	304
Heptachlor Epoxide	307
cis-Chlordane	305
trans-Nonachlor	297
Dieldrin	307
Mirex	306
2,4'-DDE	303
4,4'-DDE	306
2,4'-DDD	299
4,4'-DDD	296
2,4'-DDT	307
4,4'-DDT	302

Values in parentheses are not certified and are given for information only.
 * SI unit. Replaces "ppm" and "µg/g".

109. Organic Constituents (liquid and solid forms) – Continued

SRM 1493 Polychlorinated Biphenyl Congeners in 2,2,4-Trimethylpentane (*Iso*octane)

Selected Polychlorinated Biphenyls (PCBs) (18 certified)	Concentration (in µg/kg)
PCB 18	290.8
PCB 28	288.0
PCB 52	285.9
PCB 77	284.3
PCB 101	287.8
PCB 153	287.5
PCB 209	289.6

SRM 1581 Polychlorinated Biphenyls in Oils

Matrix	Aroclor Type	Concentration (in mg/kg)
Motor Oil	1242	100
Motor Oil	1260	100
Transformer Oil	1242	100
Transformer Oil	1260	100

SRM 1583 Chlorinated Pesticides in 2,2,4-Trimethylpentane (*Iso*octane)

Pesticide	Concentration (in mg/kg)
γ-BHC (Lindane)	1.11
δ-BHC	0.76
Aldrin	0.86
Heptachlor Epoxide	(0.997)
4,4'-DDE (p,p'-DDE)	1.23
4,4'-DDT (p,p'-DDT)	1.90

SRM 1584 Priority Pollutant Phenols in Methanol

Component	Concentration (in mg/L @ 25 °C)
2-Chlorophenol	64.4
Phenol	29.7
2-Nitrophenol	25.2
2,4-Dimethylphenol	51.6
2,4-Dichlorophenol	35.6
4-Chloro-m-cresol	27.4
2,4,6-Trichlorophenol	20.4
4-Nitrophenol	20.7
4,6-Dinitro-o-cresol	20.1
Pentachlorophenol	15.4
2,4-Dinitrophenol	(22.4)

SRM 1585 Chlorinated Biphenyls in 2,2,4-Trimethylpentane (*Iso*octane)

Polychlorinated Biphenyl (PCB)	Concentration (in mg/kg)
PCB 3	43.3
PCB 15	9.53
PCB 28	3.70
PCB 52	7.72
PCB 77	6.62
PCB 101	5.24
PCB 138	2.37
PCB 153	3.06

Values in parentheses are not certified and are given for information only.

109. Organic Constituents (liquid and solid forms) – Continued**SRM 1586 Isotopically Labeled and Unlabeled Priority Pollutants in Methanol**

Component	Concentration (in mg/kg)	
	1586-1 (unlabeled)	1586-2 (labeled)
Carbon Tetrachloride	128.5	124.4
Benzene	101.1	99.0
Chlorobenzene	133.0	144.0
Phenol	117.0	116.0
Nitrobenzene	126.0	134.5
2-Nitrophenol	103.6	101.9
2,4-Dichlorophenol	102.5	82.2
Naphthalene	126.5	126.6
Bis(2-ethylhexyl)phthalate	63.9	60.4
Benzo[a]pyrene	49.2	44.1

SRM 1587 Nitrated Polycyclic Aromatic Hydrocarbons in Methanol

Component	Concentration (in mg/kg)
2-Nitrofluorene	9.67
9-Nitroanthracene	5.01
3-Nitrofluoranthene	9.24
1-Nitropyrene	8.95
7-Nitrobenz[a]anthracene	9.27
6-Nitrochrysene	8.13
6-Nitrobenzo[a]pyrene	(6.1)

SRM 1588 Organics in Cod Liver Oil

Component	Concentration (in µg/kg)
Hexachlorobenzene	148
α-HCH	86
trans-Chlordane	50
cis-Chlordane	158
trans-Nonachlor	209
Dieldrin	150
4,4'-DDD	277
4,4'-DDE	641
2,4'-DDT	156
4,4'-DDT	529
PCB 101	261
PCB 138	276
PCB 170	45
PCB 180	107

SRM 1589 Polychlorinated Biphenyls (as Aroclor 1260) in Human Serum

Component	Concentration * (in µg/kg)
Aroclor 1260	106.0
1, 2, 3, 4-TCDD	(0.153)
2, 3, 7, 8-TCDD	(0.081)
* when reconstituted	

SRM 1596 Dinitropyrene Isomers and 1-Nitropyrene in Methylene Chloride

Component	Concentration (in mg/kg)
1-Nitropyrene	4.38
1,3-Dinitropyrene	2.10
1,6-Dinitropyrene	4.82
1,8-Dinitropyrene	8.90

Values in parentheses are not certified and are given for information only.

109. Organic Constituents (liquid and solid forms) – Continued

SRM 1614 Dioxin (2,3,7,8-TCDD in *Isooctane*)

Component	Concentration (in µg/kg)
2,3,7,8-TCDD	98.3
2,3,7,8-TCDD- ¹³ C	95.6

SRM 1639 Halocarbons (in methanol) for Water Analyses

Component	Concentration (in mg/L)
Chloroform	6235
Chlorodibromomethane	124.6
Bromodichloromethane	389.9
Bromoform	86.5
Carbon Tetrachloride	157.0
Trichloroethylene	85.8
Tetrachloroethylene	40.6

SRM 1939 Polychlorinated Biphenyls (Congeners) in River Sediment A

Component	Concentration (in mg/kg)
PCB 26	4.20
PCB 28	2.21
PCB 44	1.07

SRM 1941a Organics in Marine Sediment

Selected Components (53 certified)	Concentration (in µg/kg)
Phenanthrene	489
Anthracene	184
Fluoranthene	981
Pyrene	811
Benzo[<i>a</i>]anthracene	427
Benzo[<i>b</i>]fluoranthene	740
Benzo[<i>k</i>]fluoranthene	361
Benzo[<i>a</i>]pyrene	628
Perylene	452
Benzo[<i>ghi</i>]perylene	525
Indeno[1,2,3- <i>cd</i>]pyrene	501
2, 4'-DDE	0.73
4, 4'-DDE	6.59
4, 4'-DDD	5.06

SRM 1945 Organics in Whale Blubber

Selected Components (46 certified)	Concentration (in µg/kg)
Hexachlorobenzene	32.9
α-HCH	16.2
γ-HCH (Lindane)	3.30
Heptachlor Epoxide	10.8
Oxychlorodane	19.8
Mirex	28.9
2, 4'-DDE	12.28
4, 4'-DDE	445
2, 4'-DDD	18.1
4, 4'-DDD	133
2, 4'-DDT	106
4, 4'-DDT	245
PCB 18	4.48
PCB 44	12.2
PCB 101	65.2
PCB 209	10.6

109. Organic Constituents (liquid and solid forms) – Continued

SRM 1974a Organics in Mussel Tissue (*Mytilus Edulis*)

Component	Concentration (in µg/kg)
Phenanthrene	In Prep
Anthracene	In Prep
Fluoranthene	In Prep
Pyrene	In Prep
Perylene	In Prep
Benzo[<i>b</i>]fluoranthene	In Prep
Benzo[<i>a</i>]pyrene	In Prep
Benzo[<i>ghi</i>]perylene	In Prep
Indenol[1,2,3- <i>cd</i>]pyrene	In Prep

SRM 2261 Chlorinated Pesticides in Hexane

Pesticide	Concentration (in mg/kg)
Hexachlorobenzene	3.005
γ-HCH (Lindane)	3.012
Heptachlor	3.020
Aldrin	3.029
Heptachlor Epoxide	3.020
cis-Chlordane	3.012
trans-Nonachlor	3.034
Dieldrin	3.012
Mirex	3.041
2,4'-DDE	3.019
4,4'-DDE	3.019
2,4'-DDD	3.013
4,4'-DDD	3.043
2,4'-DDT	2.993
4,4'-DDT	3.004

SRM 2262 Chlorinated Biphenyl Congeners in 2,2,4-Trimethylpentane (*Iso*octane)

Selected Chlorinated Biphenyls (CBs) (25 certified)	Concentration (in mg/kg)
CB 1	2.997
CB 18	2.983
CB 44	2.977
CB 66	2.973
CB 101	2.950
CB 118	2.992
CB 153	2.957
CB 170	2.964
CB 206	2.900

Primary Reference Compounds

RM	Type	Purity (in Wt.%)
8466	γ-Hexachlorocyclohexane	(99.9)
8467	4,4'-DDE	(99.8)
8469	4,4'-DDT	(99.8)

Values in parentheses are not certified and are given for information only.

110. Food and Agriculture

These SRMs are for use in the calibration of apparatus and methods used in the analysis of trace elements in foods and related products.

Foods and Beverages (liquid and powder forms)

SRM	1549	1566a	1567a	1568a	1577b
Type	Non-fat Milk Powder	Oyster Tissue	Wheat Flour	Rice Flour	Bovine Liver
Unit Size	100 g	25 g	80 g	80 g	50 g
ELEMENTS	Nominal Composition in mg/kg*, unless otherwise noted.				
Aluminum	(2)	202.5	5.7	4.4	(3)
Antimony	(0.00027)	(0.01)		(0.0005)	(0.003)
Arsenic	(0.0019)	14.0	(0.006)	0.29	(0.05)
Bromine	(12)		(6)	(8)	(9.7)
Cadmium	0.0005	4.15	0.026	0.022	0.50
Calcium	1.30 Wt. %	0.196 Wt. %	0.0191 Wt. %	0.011 Wt. %	116
Chlorine	1.09 Wt. %	0.829 Wt. %	(565)	(300)	0.278 Wt. %
Chromium	0.0026	1.43			
Cobalt	(0.0041)	0.57	(0.006)	(0.018)	(0.25)
Copper	0.7	66.3	2.1	2.4	160
Fluorine	(0.20)	(240)			
Iodine	3.38	4.46	(0.0009)	(0.009)	
Iron	1.78	539	14.1	7.4	184
Lead	0.019	0.371	(< 0.020)	(< 0.010)	0.129
Magnesium	0.120 Wt. %	0.118 Wt. %	0.040 Wt. %	0.056 Wt. %	601
Manganese	0.26	12.3	9.4	20.0	10.5
Mercury	0.0003	0.0642	(0.0005)	0.0058	(0.003)
Molybdenum	(0.34)		0.48	1.46	3.5
Nickel		2.25		(0.16)	
Nitrogen		(6.81 Wt. %)			
Phosphorus	1.06 Wt. %	0.623 Wt. %	0.134 Wt. %	0.153 Wt. %	1.10 Wt. %
Potassium	1.69 Wt. %	0.790 Wt. %	0.133 Wt. %	0.1280 Wt. %	0.994 Wt. %
Rubidium	(11)	(3)	0.68	6.14	13.7
Selenium	0.11	2.21	1.1	0.38	0.73
Silver	(< 0.0003)	1.68			0.039
Sodium	0.497 Wt. %	0.417 Wt. %	6.1	6.6	0.242 Wt. %
Strontium		11.1			0.136
Sulfur	0.351 Wt. %	0.862 Wt. %	0.165 Wt. %	0.120 Wt. %	0.785 Wt. %
Tellurium				(< 0.002)	
Thorium		(0.04)			
Tin	(< 0.02)	(3)	(0.0033)	(0.0047)	
Uranium		0.132	(0.0003)	(0.0003)	
Vanadium		4.68	(0.011)	(0.007)	(0.123)
Zinc	46.1	830	11.6	19.4	127

Values in parentheses are not certified and are given for information only.

* SI unit. Replaces "ppm" and "µg/g".

110. Health Care and Nutrients (liquid and solid forms)

These SRMs are for use in determining the nutritional contents of foods. They are certified for such dietary constituents as proximates (solids, ash, protein, carbohydrate, fat and linoleate), vitamins, niacin, folic acid, pantothenic acid, biotin, choline, and selected minerals and trace elements.

SRM	Type	Certified Constituents Analytes	Values	Unit Size
Nominal Composition [In Wt.% unless identified by an asterisk which indicates mg/kg.]				
1544	Diet Composite	Fatty Acids		In Prep
1548	Total Diet	14 elements		2 bottles:
		Fat	20.6	6.5 g each
		Ash	3.5	
		Kjeldahl Nitrogen	3.4	
		Dietary Fiber	3.7	
1548a	Typical Diet			In Prep
1563	Coconut Oil	Cholesterol	642 *	10 ampules
		Retinyl Acetate	12.2 *	(5 certified)
		Ergocalciferol	10.9 *	(5 uncertified)
		dl- α -Tocopherol Acetate	158.2 *	
1845	Whole Egg Powder	Cholesterol	19.0 *	35 g
1846	Infant Formula (milk-based)	Proximates, Vitamins, Minerals		In Prep
2383	Foods/Baby Foods	Carotenoids, Vitamins		In Prep
8435	Whole Milk	Proximates, Minerals, Vitamins		In Prep
8439	Dietary Fiber	Soluble/Insoluble Fiber		In Prep

110. USA/Canada Collaborative Materials (powder form)

These materials, developed by Agriculture Canada in collaboration with NIST, are for calibrating apparatus and validating analytical methods applied to food/agricultural commodities.

RM	Type	Elements Certified
8414	Bovine Muscle Powder (Beef)	Al, As, B, Ca, Cd, Cl, Co, Cr, Cu, Fe, Hg, I, K, Mg, Mn, Mo, N, Na, Ni, P, Rb, S, Se, Sr, Zn
8415	Whole Egg Powder	Al, B, Ca, Cl, Co, Cr, Cu, Fe, Hg, I, K, Mg, Mn, Mo, N, Na, P, Pb, S, Se, Sr, V, Zn
8416	Microcrystalline Cellulose	Al, Cl, Co, Cu, Mo, N, Ni, Se
8418	Wheat Gluten	Al, Ba, Ca, Cd, Cl, Co, Cr, Cu, Fe, Hg, I, K, Mg, Mn, Mo, N, Na, Ni, P, Pb, S, Se, Sr, Zn
8432	Corn Starch	Al, Ca, Cl, Cu, K, Mg, Mo, N, Na, Ni, P, Se
8433	Corn Bran	Al, As, B, Ba, Ca, Cd, Cl, Co, Cr, Cu, Fe, Hg, I, K, Mg, Mn, Mo, N, Na, Ni, P, Pb, S, Se, Sr, V, Zn
8435	Whole Milk Powder	Ba, Br, Ca, Cl, Cu, Fe, I, K, Mg, Mn, Mo, N, Na, P, Pb, Rb, S, Se, Sr, Zn
8436	Durum Wheat Flour	Al, Ba, Br, Ca, Cd, Cl, Cr, Cu, Fe, Hg, I, K, Mg, Mn, Mo, N, Na, Ni, P, Pb, S, Se, Sr, V, Zn
8437	Hard Red Spring Wheat Flour	Ca, Cl, Cr, Cu, Fe, K, Mg, Mn, Mo, N, Na, P, S, Se, Zn
8438	Soft Winter Wheat Flour	Ca, Cl, Cu, Fe, K, Mg, Mn, Mo, N, Na, P, S, Se, Zn

110. Agricultural Materials (powder form)

SRM Type	1515 Apple Leaves	1547 Peach Leaves	1573a Tomato Leaves	1575 Pine Needles	2695 Fluoride, in Vegetation	RM 8412 Corn Stalk (Zea Mays)	RM 8413 Corn Kernel (Zea Mays)	1570a Spinach Leaves
Unit Size	50 g	50 g	50 g	70 g	2 × 25 g	34 g	47 g	60 g
ELEMENTS Concentrations are in mg/kg unless noted by a single asterisk *, for Wt.%.								
Aluminum	286	249	598	545			(4)	310
Antimony	(0.013)	(0.02)	0.063	(0.2)				
Arsenic	0.038	0.060	0.112	0.21				0.068
Barium	49	124	(63)					
Boron	27	29	33.3					37.6
Bromine	(1.8)	(11)	(1300)	(9)				
Cadmium	(0.013)	(0.026)	1.52	(<0.5)				2.89
Calcium	1.526 *	1.56 *	5.05 *	0.41 *		(2160)	(42)	1.527 *
Cerium	(3)	(10)	(2)	(0.4)				
Cesium			(53)					
Chlorine	579	360	(6600)			(2440)	(450)	
Chromium	(0.3)	(1)	1.99	2.6				
Cobalt	(0.09)	(0.07)	0.57	(0.1)				0.39
Copper	5.64	3.7	4.70	3.0		(8)	(3.0)	12.2
Europium	(0.2)	(0.17)		(0.006)				(0.0054)
Fluorine					64/277	(0.65)	(0.24)	
Gadolinium	(3)	(1)	(0.17)					
Gold	(0.001)							
Hydrogen		5.2 *						
Iodine	(0.3)	(0.3)	(0.85)					
Iron	(83)	(218)	368	200		(139)	(23)	
Lanthanum	(20)	(9)	(2.3)	(0.2)				
Lead	0.470	0.87	10.8					(0.20)
Magnesium	0.271 *	0.432 *	(1.2 *)			(1600)	(990)	(0.89 *)
Manganese	54	98	246	675		(15)	(4.0)	75.9
Mercury	0.044	0.031	0.034	0.15				0.030
Molybdenum	0.094	0.060	(0.46)					
Neodymium	(17)	(7)						
Nickel	0.91	0.69	1.59	(3.5)				2.14
Nitrogen	2.25 *	2.94 *	3.03 *	(1.2 *)		(6970)	(13750)	5.90 *
Phosphorus	0.159 *	0.137 *	0.216 *	0.12 *				0.518 *
Potassium	1.61 *	2.43 *	2.70 *	0.37 *		(17350)	(3570)	2.903 *
Rubidium	10.2	19.7	14.89	11.7				(13)
Samarium	(3)	(1)	(0.19)					
Scandium	(0.03)	(0.04)	(0.1)	(0.03)				(0.055)
Selenium	0.050	0.120	0.054			(0.016)	(0.004)	0.117
Sodium	24.4	24	136			(28)		1.818 *
Strontium	25	53	(85)	4.8		(12)		55.6
Sulfur	(0.18 *)	(0.2 *)	(0.96 *)					(0.46 *)
Tellurium								
Terbium	(0.4)	(0.1)						
Thallium				(0.05)				
Thorium	(0.03)	(0.05)	(0.12)	0.037				0.48
Tin	(<0.2)	(<0.2)						
Tungsten	(0.007)							
Uranium	(0.006)	(0.015)	(35)	0.020				(0.15)
Vanadium	0.26	0.37	0.835					0.57
Ytterbium	(0.3)	(0.02)						
Zinc	12.5	17.9	30.9			(32)	(15.7)	82

Values in parentheses are not certified and are given for information only.

110. Fertilizers (powder form)

These SRMs are intended for use in the fertilizer industry as working standards for the determination of the certified constituents.

SRM	Type	Unit Size (in g)	Composition (in Wt. %)					
			N	P	K	P ₂ O ₅	K ₂ O	CaO
120c	Phosphate Rock (Florida)	90				33.34	0.147	48.02
193	Potassium Nitrate	90	13.85		38.66			
194	Ammonium Dihydrogen Phosphate	90	12.15	26.92				
200	Potassium Dihydrogen Phosphate	90		22.74	28.76			
694	Phosphate Rock (Western)	90				30.2	0.51	43.6

SRM	SiO ₂	F	Fe ₂ O ₃	Al ₂ O ₃	MgO	Na ₂ O	MnO	TiO ₂	Cr ₂ O ₃	CdO	U	V ₂ O ₅
694	11.2	3.2	0.79	1.8	0.33	0.86	0.0116	(0.11)	(0.10)	0.015	0.01414	0.31

Values in parentheses are not certified and are given for information only.

110. Biomass Materials (powder form)

These Reference Materials, RMs 8491 Sugar Cane Bagasse (*Saccharum spp. hybrid*), 8492 Eastern Cottonwood (*P. deltoides*), 8493 Pinus Radiata, and 8494 Wheat Straw (*Triticum aestivum*) are intended primarily for use in fundamental studies on the chemical and physical properties of cellulose, hemi-cellulose and lignin and of their effects on various conversion processes. As part of the International Energy Agency (IEA) Voluntary Standards Activity Group's work, these materials were selected initially for use as research materials for a world-wide round robin analytical laboratory comparison using the Uppsala Method. They were supplied by various institutions and were prepared, packaged and are being distributed by NIST.

At this time, no extensive property measurements have been made on these materials beyond ensuring that the materials are homogeneous. A round robin is in progress with participation by international laboratories and as results become available, the Report of Investigation that accompanies each of these materials will be revised to reflect those changes.

All of the ground and homogenized materials were irradiated with Cobalt-60. The irradiation was required to meet customs regulations for shipment of biomass materials to international destinations.

RM	Type	Unit Size
8491	Sugar Cane Bagasse	In Prep
8492	Eastern Cottonwood	In Prep
8493	Pinus Radiata	In Prep
8494	Wheat Straw	In Prep

111. Geological Materials and Ores

111. Chinese Ores (powder form)

These RMs are a series of skarn deposit ores developed and certified by the Hubei Geological Research Laboratory, Hubei Province, China. Skarn ores are common in the Pacific area and other parts of the world. These RMs can be used as control samples in geochemical exploration and in environmental monitoring programs.

NOTE: In addition to the listed constituent elements, elemental concentrations are given for all major rock-forming oxides and many trace elements, including the rare earth elements and toxic trace elements important to environmental assessment programs.

RM	8600	8601	8602	8603	8604	8605	8606	8607	8608
Type	Copper	Copper	Lead	Lead	Zinc	Molybdenum	Molybdenum	Tungsten	Tungsten
Unit Size (in g)	100	100	100	100	100	100	100	100	100
Components [in Wt. %]									
Cu	1.15	0.19	0.20	0.035	0.71			0.079	0.096
Mo						1.51	0.11		
Pb			4.17	0.61	0.25				
S	0.72	0.14	0.86	0.38	2.87	1.64	0.48	3.12	1.90
W						0.36	0.10	0.015	0.22
Zn	0.059	0.013	0.062	0.092	2.75			0.29	0.010

111. Ores (powder form)

SRM/RM	79a	180	181	182	183	277	330	331	2430
Type	Fluorspar, Customs Grade	Fluorspar, High Grade	Lithium Ore (Spodumene)	Lithium Ore (Petalite)	Lithium Ore (Lepidolite)	Tungsten Concentrate	Copper Ore Mill Heads	Copper Ore Mill Tails	Scheelite Ore
Unit Size (in g)	120	120	45	45	45	100	100	100	100
Components [in Wt. % unless identified by an asterisk which indicates mg/kg]									
Ca						(0.37)			As 0.002
CaF ₂	97.39	98.80							
Cu							0.84	0.091	(0.01)
Fe						(7.4)			(1.0)
Au							(0.093*)	(0.034*)	
Li ₂ O			6.39	4.34	4.12				
Mn						(10.0)			(0.12)
Mo						(0.06)	0.018	0.0022	0.22
Nb						(1.00)			
O ₂						(21.4)			Al (0.4)
P						(0.03)			0.017
Pb						(0.07)			Bi 0.078
Re							0.30*	0.04*	
Si						(0.85)			Mg (0.5)
Ag							(1.51*)	(0.243*)	
S						(0.25)			0.26
Ta						(0.20)			(< 0.01)
Sn						(0.54)			K (0.16)
Ti						(2.2)			Na (0.02)
WO ₃						67.4			70.26

Values in parentheses are not certified and are given for information only.

111. Ores (powder form) – Continued

SRM	25d	27f	69b	120c	600	670	690	691	692	693
Type	Manganese Ore	Iron Ore, Sibley	Bauxite, Arkansas	Phosphate Rock, Florida	Bauxite, Australian	Rutile Ore	Iron Ore, Canada	Iron Oxide, Reduced	Iron Ore, Labrador	Iron Ore, Nimba
Unit Size (in g)	100	80	60	90	90	90	100	100	100	100
Components [In Wt. % unless identified by an asterisk which indicates mg/kg]										
Al ₂ O ₃	5.32	0.82	48.8	1.30	40.0		0.18	1.22	1.41	1.02
BaO	(0.21)		(0.008)							
CdO				0.0010						
CaO	(0.052)	0.039	0.13	48.02	0.22		0.20	0.63	0.023	0.016
Co			(0.0001)					0.030		
Cu								0.032		
Cr ₂ O ₃			0.011		0.024	0.23				
Total Fe		65.97					66.85	90.8	59.58	65.11
Fe ₂ O ₃	3.92		7.14	1.08	17.0	0.86				
MgO		0.019	0.085	0.32	0.05		0.18	0.52	0.035	0.013
MnO	Mn 51.78	0.011	0.110	0.027	0.013		0.23	0.043	0.46	0.091
P		0.041					0.011	0.006	0.039	0.056
P ₂ O ₅	0.25		0.118	33.34	0.039					
K ₂ O	0.93	0.008	0.068	0.147	0.23		0.0030		0.039	0.0028
SiO ₂	2.52	4.17	13.43	5.5	20.3	0.51	3.71	3.7	10.14	3.87
Na ₂ O		0.012	(0.025)	0.52	0.022		0.003	0.186	0.008	0.0028
S		0.005					0.003	0.008	0.005	0.005
SO ₃			0.551		0.155					
TiO ₂	0.13	0.019	1.90	0.103	1.31	96.16	0.022	0.27	0.045	0.035
V ₂ O ₅			0.028	0.016	0.060	0.66				
ZnO			0.0035	CO ₂ 3.27	0.003			C 0.12		
ZrO ₂			0.29	F 3.82	0.060	0.84				
Oxygen, Available	14.28									
Moisture	(0.96)									
Loss on Ignition			27.2		20.5					

Values in parentheses are not certified and are given for information only.

111. Ores (powder form) – Continued

SRM	694	696	697	698	699	886	1835
Type	Phosphate Rock, Western	Bauxite, Surinam	Bauxite, Dominican	Bauxite, Jamaican	Alumina (reduction grade)	Gold Ore, Refractory	Borate Ore
Unit Size (in g)	90	60	60	60	60	200	60
Components [in Wt. % unless identified by an asterisk which indicates mg/kg]							
Al ₂ O ₃	1.8	54.5	45.8	48.2		8.25 *	3.474
BaO		(0.004)	(0.015)	(0.008)			0.0497
C _{Total}						(5.7)	
CdO	0.015						
CaO	43.6	0.018	0.71	0.62	0.036		21.622
Co	F 3.2	(0.00009)	(0.0013)	(0.0045)			F 0.348
Cr ₂ O ₃	(0.10)	0.047	0.100	0.080	0.0002		
Fe ₂ O ₃	0.79	8.70	20.0	19.6	0.013		1.141
MgO	0.33	0.012	0.18	0.058	0.0006		3.411
MnO	0.0116	0.004	0.41	0.38	0.0005		0.0333
P ₂ O ₅	30.2	0.050	0.97	0.37	0.0002		
K ₂ O	0.51	0.009	0.062	0.010			1.261
SiO ₂	11.2	3.79	6.81	0.69	0.014		18.408
Na ₂ O	0.86	(0.007)	(0.036)	(0.015)	0.59		3.484
S _{Total}						1.466	
SO ₃		0.15	0.077	0.143		(0.7)	1.477
TiO ₂	(0.11)	2.64	2.52	2.38			0.1332
U	0.01414						
V ₂ O ₅	0.31	0.072	0.063	0.064	0.0005		
ZnO	(0.19)	0.0014	0.037	0.029	0.013		
ZrO ₂		0.14	0.065	0.061			SrO 0.9418
Ga ₂ O ₃					0.010		B ₂ O ₃ 18.739
Li ₂ O					0.002		
Loss on Ignition – See certificate for conditions		29.9	22.1	27.3	0.69		25.72

Values in parentheses are not certified and are given for information only.

111. Ore Bioleaching Substrate (powder form)

This Reference Material (RM) is for use as a bioleaching substrate and for testing bioleaching rates. The material consists of pyrite from New Mexico. Thiobacillus ferrooxidans was used in the determinations.

RM	Type	Unit Size (in g)	Bioleaching Rate (in mg Fe/L/hr)
8455	Pyrite Ore	100	12.4

111. Clays (powder form)

SRM Type Unit Size (in g)	97b	98b	679
	Flint Clay	Plastic Clay	Brick Clay
	60	60	75
Elemental Composition (in Wt. %) *			
Al	20.76	14.30	11.01
Ba	(0.018)	(0.07)	0.0432
Ca	0.0249	0.0759	0.1628
Ce			(105)*
Cs	(3.4)*	(16.5)*	(9.6)*
Cr	227*	119*	109.7*
Co	(3.8)*	(16.3)*	(26)*
Eu	(0.84)*	(1.3)*	(1.9)*
Hf	(13)*	(7.2)*	(4.6)*
Fe	0.831	1.18	9.05
Li	550*	215*	71.7*
Mg	0.113	0.358	0.7552
Mn	47*	116*	(1730)*
P	(0.02)	(0.03)	(0.075)
K	0.513	2.81	2.433
Rb	(33)*	(180)*	(190)*
Sc	(22)*	(22)*	(22.5)*
Si	19.81	26.65	24.34
Na	0.0492	0.1496	0.1304
Sr	84*	189*	73.4*
Th	(36)*	(21)*	(14)*
Ti	1.43	0.809	0.577
Zn	(87)*	(110)*	(150)*
Zr	(0.05)	(0.022)	
Sb	(2.2)*	(1.6)*	
Loss on Ignition**	(13.3)	(7.5)	

Values in parentheses are not certified and are given for information only.

* Value is in mg/kg (SI unit).

**At 1100 °C, 2 hours; sample previously dried.

111. Rocks and Minerals (powder form)

SRM	1c	70a	81a	88b	99a	165a	278	688	1413
Type	Limestone, Argillaceous	Feldspar, Potash	Glass Sand	Limestone, Dolomite	Feldspar, Soda	Glass Sand (low iron)	Obsidian Rock	Basalt Rock	Glass Sand (high alumina)
Unit Size (in g)	50	40	75	75	40	75	35	60	75
Components [in Wt. % unless identified by an asterisk which indicates mg/kg.]									
Al ₂ O ₃	1.30	17.9	0.66	0.336	20.5	0.059	14.15	17.36	9.90
BaO		0.02		CO ₂ 46.37	0.26		Ba (1140 *)		0.12
CaO	50.3	0.11		29.95	2.14		0.983	(12.17)	0.74
Cr ₂ O ₃			46 *			(1 *)	Cr (6.1 *)	Cr 332 *	
Fe ₂ O ₃ †	0.55	0.075	0.082	0.277	0.065	0.012	2.04	10.35	0.24
FeO †							1.36	7.64	
MgO	0.42			21.03	0.02		(0.23)	(8.4)	0.06
MnO	0.025			0.0160			0.052	0.167	
P ₂ O ₅	0.04			0.0044	0.02		0.036	0.134	
K ₂ O	0.28	11.8		0.1030	5.2		4.16	0.187	3.94
Rb ₂ O		0.06					Rb 127.5 *	Rb 1.91 *	
SiO ₂	6.84	67.12		1.13	65.2		73.05	48.4	82.77
Na ₂ O	0.02	2.55		0.0290	6.2		4.84	2.15	1.75
SrO	0.030			0.0076			Sr 63.5 *	Sr 169.2 *	
TiO ₂	0.07	0.01	0.12	(0.016)	0.007	0.011	0.245	1.17	0.11
ZrO ₂			0.034			0.006			
Loss on Ignition – See certificate for conditions	39.9	0.40		(46.98)	0.26				

Values in parentheses are not certified and are given for information only.

† Refer to certificate to ascertain if the value reported represents total iron or species-specific iron.

111. Refractories (powder form)

SRM	76a	77a	78a	154b	198	199
Type	Burnt Refractory (Al ₂ O ₃ –40%)	Burnt Refractory (Al ₂ O ₃ –60%)	Burnt Refractory (Al ₂ O ₃ –70%)	Titanium Dioxide	Silica Brick	Silica Brick
Unit Size (in g)	75	75	75	90	45	45
Components (in Wt. %)						
Al ₂ O ₃	38.7	60.2	71.7		0.16	0.48
CaO	0.22	0.05	0.11	(~0.01)	2.71	2.41
FeO *						
Fe ₂ O ₃ *	1.60	1.00	1.2	(0.006)	0.66	0.74
Li ₂ O	0.042	0.025	0.12		0.001	0.002
MgO	0.52	0.38	0.70	(~0.01)	0.07	0.13
MnO					0.008	0.007
P ₂ O ₅	0.120	0.092	1.3	(0.04)	0.022	0.015
K ₂ O	1.33	0.090	1.22		0.017	0.094
SiO ₂	54.9	35.0	19.4	(0.01)		
Na ₂ O	0.07	0.037	0.078		0.012	0.015
SrO	0.037	0.009	0.25			
TiO ₂	2.03	2.66	3.22	99.74	0.02	0.06
ZrO ₂						
Loss on Ignition	(0.34)	(0.22)	(0.42)		0.21	0.17

Values in parentheses are not certified and are given for information only.

* Refer to certificate to ascertain if the value reported represents total iron or species-specific iron.

111. Soils and Sediments (powder form)

SRM/RM	1646a	2704	2709	2710	2711	8406	8407
Type	Estua- rine Sediment	Buffalo River Sediment	San Joaquin Soil	Montana Soil Highly Elevated Traces	Montana Soil Moderately Elevated Traces	Tennessee River Sediment	Tennessee River Sediment
Unit Size	75 g	50 g	50 g	50 g	50 g	25 g	25 g
ELEMENT Concentrations are in mg/kg, unless noted by a single asterisk, *, for Wt. %.							
Aluminum	2.297 *	6.11 *	7.50 *	6.44 *	6.53 *		
Antimony	(0.3)	3.79	7.9	38.4	19.4		
Arsenic	6.23	23.4	17.7	626	105		
Barium	(210)	414	968	707	726		
Beryllium	(< 1)						
Bromine		(7)		(6)	(5)		
Cadmium	0.148	3.45	0.38	21.8	41.7		
Calcium	0.519 *	2.60 *	1.89 *	1.25 *	2.88 *		
Carbon		3.348 *	(1.2 *)	(3 *)	(2 *)		
Cerium	(34)	(72)	(42)	(57)	(69)		
Cesium		(6)	(5.3)	(107)	(6.1)		
Chlorine		(< 0.01 *)					
Chromium	40.9	135	130	(39)	(47)		
Cobalt	(5)	14.0	13.4	(10)	(10)		
Copper	10.01	98.6	34.6	2950	114		
Dysprosium		(6)	(3.5)	(5.4)	(5.6)		
Europium		(1.3)	(0.9)	(1)	(1.1)		
Gallium	(5)	(15)	(14)	(34)	(15)		
Germanium							
Gold			(0.3)	(0.6)	(0.03)		
Hafnium		(8)	(3.7)	(3.2)	(7.3)		
Holmium			(0.54)	(0.6)	(1)		
Indium				(5.1)	(1.1)		
Iodine		(2)	(5)		(3)		
Iron (Total)	2.008 *	4.11 *	3.50 *	3.38 *	2.89 *		
Lanthanum	(17)	(29)	(23)	(34)	(40)		
Lead	11.7	161	18.9	5532	1162		
Lithium	(18)	47.5					
Magnesium	0.388 *	1.20 *	1.51 *	0.853 *	1.05 *		
Manganese	234.5	555	538	1.01 *	638		
Mercury	(0.04)	1.47	1.40	32.6	6.25	(0.06)	(50)
Molybdenum	(1.8)		(2.0)	(19)	(1.6)		
Neodymium	(15)		(19)	(23)	(31)		
Nickel	22.5	44.1	88	14.3	20.6		
Phosphorus	0.027 *	0.0998 *	0.062 *	0.106 *	0.086 *		
Potassium	0.864	2.00 *	2.03 *	2.11 *	2.45 *		
Rubidium	(38)	(100)	(96)	(120)	(110)		
Samarium		(6.7)	(3.8)	(7.8)	(5.9)		
Scandium	(5)	(12)	(12)	(8.7)	(9)		
Selenium	0.193	1.12	1.57		1.52		
Silicon	40.00 *	29.08 *	29.66 *	28.97 *	30.44 *		
Silver			0.41	35.3	4.63		
Sodium	0.741 *	0.547 *	1.16 *	1.14 *	1.14 *		
Strontium	(68)	(130)	231	(240)	245.3		
Sulfur	0.352 *	0.397 *	0.089 *	0.240 *	0.042 *		
Thallium	(< 0.5)	1.06	0.74	(1.3)	2.47		
Thorium	(5.8)	(9.2)	(11)	(13)	(14)		
Titanium	0.456 *	0.457 *	0.342 *	0.283 *	0.306 *		
Tungsten			(2)	(93)	(3)		
Uranium	(2.0)	3.13	(3)	(25)	(2.6)		
Vanadium	44.84 *	95	112	76.6	81.6		
Ytterbium		(2.8)	(1.6)	(1.3)	(2.7)		
Yttrium			(18)	(23)	(25)		
Zinc	48.9	438	106	6952	350.4		
Zirconium		(300)	(160)		(230)		

Values in parentheses are not certified and are given for information only.

112. Ceramics and Glasses

Carbides (powder form)

SRM	Type	Unit Size (in g)	Composition (in Wt. %)							
			SiC	Total C	Free C	Fe	O	N	Al	Ca
112b	Silicon Carbide	80	97.37	29.43	0.26	0.13			0.44	0.04
276b	Tungsten Carbide	75		6.10	(0.04)		(0.08)	(0.01)		

Values in parentheses are not certified and are given for information only.

112. Cemented Carbides (powder form)

SRMs 887-9 are prepared from sintered tungsten carbide base materials.

SRM	887	888	889
Type	Cemented Carbide (W83-Co10)	Cemented Carbide (W64-Co25-Ta5)	Cemented Carbide (W75-Co9-Ta5-Ti4)
Unit Size (in g)	100	100	100
Elemental Composition (in Wt. %)			
Co	10.35	24.7	9.50
Ta		4.77	4.60
Ti			4.03
C	(5.5)	(4.6)	(6.0)

Values in parentheses are not certified and are given for information only.

112. Glasses (powder and solid forms)

SRM	81a	89	91	92	93a	165a	620	621	1411	1412	1413	1830	1831	1834
Type	Glass Sand	Lead-Barium	Opal Powder	Low-Boron Soda-Lime Powder	High-Boron Borosilicate	Glass Sand (low Iron)	Soda-Lime, Flat	Soda-Lime, Container	Soft Borosilicate	Multi Component	Glass Sand (high) alumina)	Soda-Lime, Float	Soda-Lime, Sheet	Fused Ore Glass
Unit Size	75 g	45 g	45 g	45 g	wafer 32 mm D×6 mm	75 g	3 platelets 35×35×3 mm	3 disks 38 mm D×5 mm	10 platelets 32×32×3 mm	8 platelets 32×32×3 mm	75 g	3 platelets 38×38×6 mm	3 platelets 37×37×3 mm	disk 30 mm D×3 mm
Components [in Wt. % unless identified by an asterisk which indicates mg/kg.]														
SiO ₂		65.35	67.5	(75.0)	80.8		72.08	71.13	58.04	42.38	82.77	73.07	73.08	Si 20.19
PbO		17.50	0.10							4.40				
Al ₂ O ₃	0.66	0.18	6.01		2.28	0.059	1.80	2.76	5.68	7.52	9.90	0.12	1.21	Al 20.71
FeO					0.016							0.032	0.025	
Fe ₂ O ₃	0.082	0.049	0.079		0.028	0.012	0.043	0.040	0.050	(0.031)	0.24	0.121	0.087	Fe 0.32
ZnO			0.08	(0.2)					3.85	4.48				
CdO										4.38				
MnO		0.088												
TiO ₂	0.12	0.01	0.019		0.014	0.011	0.018	0.014	0.02			0.011	0.019	Ti 1.11
ZrO ₂	0.034	0.005	0.009		0.042	0.006		0.007						Zr (0.047)
CaO		0.21	10.49	(8.3)	0.01		7.11	10.71	2.18	4.53	0.74	8.56	8.20	Ca 0.095
BaO		1.40						0.12	5.00	4.67	0.12			Ba 0.062
Li ₂ O										(4.50)				Li (4.6)
MgO		0.03		(0.1)	0.005		3.69	0.27	0.33	(4.69)	0.06	3.90	3.51	Mg 0.088
K ₂ O		8.40	3.24	(0.6)	0.014		0.41	2.01	2.97	4.14	3.94	0.04	0.33	K 0.42
Na ₂ O		5.70	8.47	(13.1)	3.98		14.39	12.74	10.14	4.69	1.75	13.75	13.32	Na (0.14)
B ₂ O ₃				0.70	12.56				10.94	4.53				B (1.1)
P ₂ O ₅		0.23	0.023											P 0.152
As ₂ O ₅		0.36	0.10											
As ₂ O ₃		0.03	0.09				0.056	0.030						
SO ₃		0.03					0.28	0.13				0.26	0.25	
Cl		0.05	0.015		0.060									
Cr														(0.02)
SrO									0.09	4.55				Sr 0.153
F			5.73											
Cr ₂ O ₃	46 *					(1 *)								
Loss on Ignition		0.32		(0.42)										

Values in parentheses are not certified and are given for information only.

112. Trace Elements (powder and wafer forms)

These SRMs are for calibrating instruments and evaluating analytical techniques used to determine trace elements in inorganic matrices.

SRM	607	610 and 611	612 and 613	614 and 615	616 and 617
Type	Trace Elements in Potassium Feldspar	Trace Elements in Glass	Trace Elements in Glass	Trace Elements in Glass	Trace Elements in Glass
Wafer Thickness (in mm)		1	3 and 1	3 and 1	3 and 1
Unit Size	5 g	6 wafers	6 wafers	6 wafers	6 wafers
Element	Composition (in mg/kg)				
Antimony				(1.06)	(0.078)
Barium			(41)		
Boron		(351)	(32)	(1.30)	(0.20)
Cadmium				(0.55)	
Cerium			(39)		
Cobalt		(390)	(35.5)	(0.73)	
Copper		(444)	(37.7)	1.37	(0.80)
Dysprosium			(35)		
Erbium			(39)		
Europium			(36)	(0.99)	
Gadolinium			(39)		
Gallium				(1.3)	(0.23)
Gold		(25)	(5)	(0.5)	(0.18)
Iron		458	51	(13.3)	(11)
Lanthanum			(36)	(0.83)	(0.034)
Lead		426	38.57	2.32	1.85
Manganese		485	(39.6)		
Neodymium			(36)		
Nickel		458.7	38.8	(0.95)	
Potassium		(461)	(64)	30	29
Rubidium	523.90	425.7	31.4	0.855	(0.100)
Samarium			(39)		
Scandium				(0.59)	(0.026)
Silver		(254)	22.0	0.42	
Strontium	65.485 *	515.5	78.4	45.8	41.72
Thallium		(61.8)	(15.7)	(0.269)	(0.0082)
Thorium		457.2	37.79	0.748	0.0252
Titanium		(437)	(50.1)	(3.1)	(2.5)
Uranium		461.5	37.38	0.823	0.0721
Ytterbium			(42)		
Zinc		(433)			

In addition to the elements listed above, the glass SRMs contain the following 25 elements: As, Be, Bi, Cs, Cl, F, Ge, Hf, Hg, Li, Lu, Mg, Nb, P, Pr, Se, S, Te, Tb, Tm, Sn, W, V, Y, and Zr.

NOTE: Glass—Nominal Composition; 72% SiO₂, 12% CaO, 14% Na₂O, and 2% Al₂O₃.

Values in parentheses are not certified and are given for information only.

* Also certified for isotopic ratio – ⁸⁷Sr/⁸⁶Sr = 1.20039.

113. Cement

Portland Cements (powder form)

These SRMs are for X-ray spectroscopic and chemical analysis of portland cements and related materials. Each unit consists of three (3) sealed vials, each containing ~5 g of material.

SRM	1880	1881	1882	1883	1884
COLOR	BLACK	WHITE	ORANGE	SILVER	IVORY
Components (in Wt. %)					
CaO	63.14	58.67	37.6	27.8	64.01
SiO ₂	19.82	22.25	3.40	0.35	23.19
Al ₂ O ₃	5.03	4.16	38.6	71.2	3.31
Fe ₂ O ₃	2.91	4.68	15.8	0.08	3.30
SO ₃	3.37	3.65			1.67
MgO	2.69	2.63	1.25	0.29	2.32
K ₂ O	0.91	1.17	0.12	(0.01)	0.51
TiO ₂	0.23	0.25	1.83	(0.01)	0.16
Na ₂ O	0.28	0.04	(0.06)	0.32	0.13
SrO	0.06	0.11			0.048
P ₂ O ₅	0.29	0.09			0.12
Mn ₂ O ₃	0.08	0.26			0.11
F	0.10	0.09			(0.03)
ZnO	0.01	0.01			(0.02)
Cr ₂ O ₃					(<0.01)
Cl	0.02	0.01			(0)
Loss on Ignition at 1000 °C	1.38	2.01	1.58	0.42	1.17
Total	100.28	100.04			(100.05)

SRM	1885	1886	1887	1888	1889
COLOR	TURQUOISE	CRANBERRY	BROWN	PURPLE	GRAY
Components (in Wt. %)					
CaO	62.14	67.43	62.88	63.78	65.08
SiO ₂	21.24	22.53	19.98	20.86	20.44
Al ₂ O ₃	3.68	3.99	5.59	5.35	5.61
Fe ₂ O ₃	4.40	0.31	2.16	3.18	2.67
SO ₃	2.22	2.04	4.61	3.16	2.68
MgO	4.02	1.60	1.26	0.71	1.38
K ₂ O	0.83	0.16	1.27	0.56	0.32
TiO ₂	0.20	0.19	0.27	0.29	0.21
Na ₂ O	0.38	0.02	0.10	0.14	0.11
SrO	0.037	0.11	0.07	0.07	0.20
P ₂ O ₅	0.10	0.025	0.075	0.085	0.15
Mn ₂ O ₃	0.12	0.013	0.072	0.025	0.24
F	(0.05)	(0.01)	(0.11)	(0.02)	(0.04)
ZnO	(0.03)	(<0.01)	(0.01)	(0.01)	(<0.01)
Cr ₂ O ₃	(<0.01)	(<0.01)	(<0.01)	(0.01)	(0.01)
Cl	(0.02)	(0)	(0.007)	(0.015)	(0.002)
Loss on Ignition at 1000 °C	0.74	1.73	1.49	1.79	0.92
Total	(100.19)	(100.02)	(99.908)	(100.05)	(100.04)

Values in parentheses are not certified and are given for information only.

113. Portland Cement Clinkers

These RMs are intended primarily for use in the determination of the abundance of major phases in cement clinkers, i.e., the percentages of alite (C_3S), belite (C_2S), aluminate (C_3A), and ferrite ($(C_2(A,F))$).

Note: In cement chemist notation, C=CaO, S=SiO₂, A=Al₂O₃ and F=Fe₂O₃.

RM	8486	8487	8488
Type	Portland Cement Clinker	Portland Cement Clinker	Portland Cement Clinker
Unit Size (in g)	3×10	3×10	3×10
Components (in Wt. %)			
CaO	(63.36)	(67.20)	(66.50)
SiO ₂	(22.48)	(21.43)	(22.68)
Al ₂ O ₃	(4.70)	(5.53)	(4.90)
Fe ₂ O ₃	(3.60)	(1.98)	(4.07)
SO ₃	(0.27)	(0.83)	(0.31)
MgO	(4.73)	(1.48)	(0.98)
K ₂ O	(0.42)	(0.72)	(0.35)
TiO ₂	(0.25)	(0.27)	(0.24)
Na ₂ O	(0.10)	(0.14)	(0.11)
SrO	(0.05)	(0.11)	(0.13)
P ₂ O ₅	(0.06)	(0.29)	(0.08)
Mn ₂ O ₃	(0.10)	(0.04)	(0.03)
Loss on Ignition	(0.16)	(0.17)	(0.21)
Total	(100.28)	(100.20)	(100.60)
Alite (C_3S)	(58.47)	(73.39)	(64.97)
Belite (C_2S)	(23.18)	(7.75)	(18.51)
Aluminate (C_3A)	(1.15)	(12.09)	(4.34)
Ferrite ($C_2(A,F)$)	(13.68)	(3.27)	(12.12)
Free CaO	(0.18)	(2.45)	(0.00)
Periclase	(3.21)	(0.09)	(0.05)
Alkali Sulfate	(0.14)	(0.98)	(0.03)
Total	(100.01)	(100.02)	(100.02)

Values in parentheses are not certified and are given for information only.

114. Engine Wear Materials

114. Metallo-Organic Compounds (liquid form)

These SRMs are for preparing solutions in oils of known and reproducible concentrations of metals. Each SRM unit consists of 5 g of material.

SRM	Type	Elemental Composition (in Wt. %)	
1051b	Barium cyclohexanebutyrate	Barium	28.7
1052b	Bis(1-phenyl-1,3-butanediono)oxovanadium (IV)	Vanadium	13.01
1053a	Cadmium cyclohexanebutyrate	Cadmium	24.8
1057b	Dibutyltin bis (2-ethylhexanoate)	Tin	22.95
1059c	Lead cyclohexanebutyrate	Lead	37.5
1060a	Lithium cyclohexanebutyrate	Lithium	4.1
1065b	Nickel cyclohexanebutyrate	Nickel	13.89
1066a	Octaphenylcyclotetrasiloxane	Silicon	14.14
1069b	Sodium cyclohexanebutyrate	Sodium	12.0
1070a	Strontium cyclohexanebutyrate	Strontium	20.7
1071b	Triphenyl phosphate	Phosphorus	9.48
1073b	Zinc cyclohexanebutyrate	Zinc	16.66
1075a	Aluminum 2-ethylhexanoate	Aluminum	8.07
1077a	Silver 2-ethylhexanoate	Silver	42.60
1078b	Tris (1-phenyl-1,3-butanediono)chromium (III)	Chromium	9.6
1079b	Tris (1-phenyl-1,3-butanediono)iron (III)	Iron	10.45
1080a	Bis(1-phenyl-1,3-butanediono)copper (II)	Copper	16.37

114. Lubricating Base Oils (liquid form)

These SRMs are for determining the concentrations of a single element in lubricating base oil. SRMs 1818a and 1819a consist of five (5) bottles, 20 g each; SRM 1836 consists of four (4) vials, ~4 g each.

SRM	Type	Elemental Composition (in mg/kg)				
		I	II	III	IV	V
1818a	Total Chlorine	31.6	60.0	78.2	154.4	234.0
1819a	Total Sulfur	423.5	741.1	4022	4689	6135
1836	Total Nitrogen	9.0	50.9	113.3	166.2	

114. Catalyst Characterization Material (liquid form)

This Reference Material (RM) is for determining the activity of FCC Catalysts by Microactivity Test. It is distributed by NIST in cooperation with the American Society for Testing and Materials (ASTM).

RM	Type	Unit Size
8590	High Sulfur Gas Oil Feed	946 mL

114. Catalyst Package for Lubricant Oxidation (liquid form)

These reference materials are for evaluating the oxidation stability of lubricating oils, i.e., automotive crankcase lubricants. SRM 1817c consists of a set of five (5) ampules of each of three (3) materials. The fuel fraction and the metal mixture are sealed under inert atmosphere. RM 8501 consists of a set of five (5) ampules of each of four (4) materials. The fuel fraction, model compound, and metal mixture are sealed under inert atmosphere.

SRM/RM	Type	Consisting of	Unit Size
1817c	Catalyst Package IIID	1) an Oxidized/Nitrated Fuel Fraction, 2) a Metal Naphthenate Mixture, and 3) Distilled Water	5 × 0.15 g 5 × 0.3 g 5 × 1.0 g
2567	Catalyst Package IIIE	1) an Oxidized/Nitrated Fuel Fraction, 2) a Nitro-Paraffin Model Compound, 3) a Nitro-Aromatic Model Compound, 4) a Metal Naphthenate Mixture, and 5) Distilled Water	In Prep
8501	Catalyst Package IIIE	1) an Oxidized/Nitrated Fuel Fraction, 2) a Nitro-Paraffin Model Compound, 3) a Metal Naphthenate Mixture, and 4) Distilled Water	5 × 0.15 g 5 × 0.15 g 5 × 0.3 g 5 × 1.0 g

114. Wear-Metals in Oil (liquid form)

SRM	Type	Unit Size	Elemental Composition (in mg/kg)				
			Al	Cr	Cu	Fe	Pb
1083	Wear-Metals (base oil)	150 mL	(<0.5)	(<0.02)	(<0.5)	(<1)	(<0.04)
1084a	Wear-Metals	Set of 5 ampules: 1.6 g each	(104)	98.3	100.0	98.9	101.1
1085a	Wear-Metals	Set of 5 ampules: 1.6 g each	(289)	296.3	295.1	296.8	297.4
SRM	Mg	Mn	Mo	Ni	Si	Ag	
1083	(<0.1)	(<0.005)	(<0.01)	(<0.4)	(<1)	(<0.05)	
1084a	99.5		100.3	99.7	(103)	101.4	
1085a	296.0		302.9	302.9	(322)	305.7	
SRM	Na	Sn	S	Ti	V	Zn	
1083	(<0.06)	(<0.4)	(<1)	(<5)	(<0.3)	(<0.08)	
1084a		97.2	(1700)	100.4	95.9		
1085a		296.0	(4500)	305.1	292.4		

Values in parentheses are not certified and are given for information only.

Physical Properties



Standard Reference Materials

for

Physical Properties

201. Ion Activity

pH Calibration (powder form)

These SRMs are used to prepare solutions of known hydrogen ion activity to calibrate commercial pH instruments. SRMs 186Ie and 186IIe, 191a and 192a are each certified for use as an admixture only. SRMs 186Ie and 186IIe may be used to prepare solutions with a pH of 6.863 at 25 °C, or physiological buffer solutions with a pH of 7.41 at 25 °C.

SRM	Type	pH(S) Values (at 25 °C)	Unit Size (in g)
185g	Potassium Hydrogen Phthalate	4.006	60
186Ie	Potassium Dihydrogen Phosphate	(see above)	30
186IIe	Disodium Hydrogen Phosphate		30
187c	Sodium Tetraborate Decahydrate (Borax)	9.180	30
188	Potassium Hydrogen Tartrate	3.557	60
189a	Potassium Tetroxalate	1.681	65
191a	Sodium Bicarbonate	10.011	25
192a	Sodium Carbonate		30
2193	Calcium Carbonate	12.46	30

201. Biological Buffer Systems (powder form)

These SRMs are used to calibrate clinical instruments (e.g., blood pH measurements), in the physiologically important range of pH 7 to 8. They are based on a biological buffer system for clinical pH measurements and are each certified for use as an admixture only. The pH(S) values for the buffer solutions are certified at 0.05 molal and 0.08 molal with respect to the free acid and the sodium salt admixture as a function of temperature. The certified temperature range is from 0 °C to 50 °C.

SRM	Type	pH(S) Values (at 37 °C)		Unit Size (in g)
		0.05 molal	0.08 molal	60
2181	HEPES Free Acid	7.364	7.373	60
2182	NaHEPESate			60
2183	MOPSO Free Acid	6.699	6.676	60
2184	NaMOPSOate			60

201. pD Calibration (powder form)

These SRMs are for the preparation of solutions of known deuterium ion activity to calibrate pH instruments to indicate pD data. SRMs 2186I and 2186II, and 2191a and 2192a are certified for use as admixtures only.

SRM	Type	pD(S) Values (at 25 °C)	Unit Size (in g)
2185	Potassium Hydrogen Phthalate	4.518	60
2186I	Potassium Dihydrogen Phosphate	7.428	30
2186II	Disodium Hydrogen Phosphate		30
2191a	Sodium Bicarbonate	10.732	30
2192a	Sodium Carbonate		30

201. Ion-Selective Electrode Calibration (powder form)

These SRMs are certified for the calibration of ion-selective electrodes and have conventional ionic activities based on the Stokes-Robinson hydration theory for ionic strengths greater than 0.1 mol/L.

SRM	Type	Certified Component	Unit Size (in g)
2201	Sodium Chloride	pNa, pCl	125
2202	Potassium Chloride	pK, pCl	160
2203	Potassium Fluoride	pF	125

201. Electrolytic Conductivity (liquid form)

These SRMs are for calibrating and standardizing conductivity cells and meters used in water purity determinations and in clinical applications. SRM 3190 is an aqueous solution of hydrochloric acid; SRMs 3191 through 3195 are solutions of high-purity potassium chloride in de-ionized water in equilibrium with atmospheric carbon dioxide. SRM 3196 is a solution of high purity sodium chloride in de-ionized water in equilibrium with atmospheric carbon dioxide. (NOTE: This SRM closely matches biological fluids for conductivity measurements in clinical materials. SRMs 3190–3195 are less suitable for such purposes.) SRMs 3198 and 3199 are solutions of potassium chloride in a mixture of n-propanol and de-ionized water.

SRM	Type	Nominal Conductivity ($\mu\text{S/cm}$)	Unit Size (in mL)
3190	HCl in de-ionized H_2O	25	500
3191	KCl in de-ionized H_2O	100	500
3192	KCl in de-ionized H_2O	500	500
3193	KCl in de-ionized H_2O	1000	500
3194	KCl in de-ionized H_2O	10000	500
3195	KCl in de-ionized H_2O	100000	500
3196	NaCl in de-ionized H_2O	20000	500
3198	KCl in n-propanol/de-ionized H_2O	5	500
3199	KCl in n-propanol/de-ionized H_2O	15	500

202. Polymeric Properties

Molecular Weight and Melt Flow (liquid, pellet and powder forms)

These SRMs are for the calibration of instrumentation used in polymer technology science for the determination of molecular weight and molecular weight distribution and as characterized samples for other physical properties of polymers.

SRM	Type	Unit Size (in g)
705a	Polystyrene, narrow molecular weight distribution, $M_w \approx 179,300$, $M_w/M_n \approx 1.07$	5
706	Polystyrene, broad molecular weight distribution, $M_w \approx 257,800$, $M_w/M_n \approx 2.1$	18
1473	Polyethylene Resin, low density, melt flow	60
1474	Polyethylene Resin, melt flow	60
1475a	Polyethylene, linear, $M_w \approx 52,000$ ($M_z:M_w:M_n \approx 7.54:2.90:1$)	50
1478	Polystyrene, narrow molecular weight distribution, $M_w \approx 37,400$ ($M_w/M_n \approx 1.04$)	2
1479	Polystyrene, narrow molecular weight distribution, $M_w \approx 1,050,000$	2
1480	Polyurethane ($M_w \approx 47,300$)	1
1482	Polyethylene, linear, $M_w \approx 13,600$ ($M_w/M_n \approx 1.19$)	1
1483	Polyethylene, linear, $M_w \approx 32,100$ ($M_w/M_n \approx 1.11$)	1
1484a	Polyethylene, linear, $M_w \approx 119,600$ ($M_w/M_n \approx 1.19$)	0.3
1487	Poly(methylmethacrylate), $M_n \approx 6,000$	2
1488	Poly(methylmethacrylate), $M_n \approx 29,000$	2
1489	Poly(methylmethacrylate), $M_n \approx 115,000$	2
1496	Polyethylene Gas Pipe Resin, melt flow (Unpigmented)	908
1497	Polyethylene Gas Pipe Resin, melt flow (Pigmented)	9080
1923	Poly(ethylene oxide), $M_w \approx 26,900$ ($M_w/M_n \approx 1.04$)	0.2
1924	Poly(ethylene oxide), $M_w \approx 120,900$ ($M_w/M_n \approx 1.06$)	0.2

Property	Method	705a	706	1473	1474	1475a	1478	1479	1480	1482	1483	1484a	1487	1488	1489	1496	1497	1923	1924
Molecular Weight: Weight Average	(Light Scattering)	X	X			X		X	X	X	X	X						X	X
	(Sed. Equili.)	X	X				X						X	X					
	(Gel Permeation/Filtration Chromatography-GPC)																	X	X
Number Average	(Osmometry)	X					X			X	X	X			X				
	(Size Excl. Chromatography)					X			X										
Molecular Weight Distribution	(GPC)					X													
Limiting Viscosity No.	(Capillary Viscometry)																		
Benzene, 25 °C		X	X																
Benzene, 35 °C		X																	
Cyclohexane, 35 °C		X	X																
1-Chloronaphthalene, 130 °C						X				X	X	X							
1,2,4-Trichlorobenzene, 130 °C						X				X	X	X							
Decahydronaphthalene, 130 °C						X													
Tetrahydrofuran, 25 °C								X					X						
Toluene, 25 °C							X								X	X			
Melt Flow	(ASTM)			X	X	X										X	X		
Density	(ASTM)					X													
Heat Capacity	(Adiabatic)	X				X													

202. Polyethylene Pipe Products

These Reference Materials (RMs) are for the testing and characterization of polyethylene pipe products.

RM	Type	Tensile Properties* (in MPa)	Melt Flow (in g/10 min)	Density (in g/cm ³)
8450	Polyethylene Piping, 1.3 cm	16.40/0.125	0.851	0.938
8451	Polyethylene Piping, 4.8 cm	17.35/0.127		0.937
8452	Polyethylene Piping, 10.2 cm			0.938
8453	Polyethylene Socket T Joint		0.508	
8454	Polyethylene Butt T Joint		0.996	

* Expressed as Yield Stress/Strain at Yield (Strain Rate = 81% per minute).

202. Rubbers and Rubber Compounding Materials (powder and solid forms)

These SRMs have been prepared to provide the rubber industry with standard materials for rubber compounding. They are useful for the testing of rubber and rubber compounding materials in connection with quality control of raw materials and for the standardization of rubber testing.

Each material has been statistically evaluated for uniformity by mixing rubber and rubber compounds, vulcanizing them in accordance with ASTM Designation D-3182 and determining the stress-strain properties of the resulting vulcanizates. A certificate is issued for the rubber SRM 386k, because the properties of different lots are not the same. Replacement lots of rubber compounding SRMs 371h, 372i, and 383a, impart essentially the same characteristics to rubber vulcanizates so that certificates are not issued for these SRMs.

SRM/RM	Type	Unit Size (in kg)
371h	Sulfur	6
372i	Stearic Acid	3.2
383a	Mercaptobenzothiazole	3.2
386k	Styrene-Butadiene 1500	36
8384	N-tertiary-butyl-2-benzothiazole sulfenamide (TBBS), powder	3.2

203. Thermodynamic Properties

Combustion Calorimetry (powder form)

These SRMs are for use as standards for calibration of combustion bomb calorimeters used in checking the performance of apparatus and analytical procedures and for the characterization of high-purity compounds, fuels, and related fuel materials.

SRM	Type	Heat of Combustion (in MJ/kg)*	Unit Size (in g)
39i	Benzoic Acid	26.434	30
1656	Thianthrene	33.480	30
1657	Synthetic Refuse-Derived Fuel	13.87 **	100
2151	Nicotinic Acid	22.184	25
2152	Urea	10.536	25
2682a	Coal, Sub-bituminous: %S = 0.486; %Ash = 6.3	25.48 **	50
2683a	Coal, Bituminous: %S = 1.89; %Ash = 6.8	31.90 **	50
2684a	Coal, Bituminous: %S = 3.06; %Ash = 11.0	28.50 **	50
2685a	Coal, Bituminous: %S = 4.730; %Ash = 16.21	26.67 **	50
2692a	Coal, Bituminous: %S = 1.184; %Ash = 7.94	32.64 **	50

* The calorific values (MJ/kg) may decrease upon the aging or normal oxidation of the coals. NIST will continue to monitor these calorific values and report any substantive change to the purchaser.

** Gross calorific value or HHV (Higher Heating Value).

203. Solution Calorimetry

SRM	Type	Heat of Solution (in MJ/kg)	Unit Size (in g)
724a	Tris(hydroxymethyl)aminomethane	HCl Evolved - 0.24576 NaOH Absorbed - 0.1418	50
1655	Potassium Chloride (Water Solution Calorimetry)	Absorbed (0.235)	30

203. Enthalpy and Heat Capacity (solid forms)

SRM	Type	Unit Size	Temperature Range (in K)	Molecular Weight (in g/mol)
RM 5	Copper	0.19 D × 12 cm	25 to 300	170,900
705a	Polystyrene	5 g	10 to 350	
720	Synthetic Sapphire	15 g	10 to 2250	
781-D2	Molybdenum	0.64 D × 10 cm	273.15 to 2800	

203. Differential Scanning Calorimetry (solid forms)

These SRMs are for calibrating differential scanning calorimeters, differential thermal analyzers, and similar instruments. SRM 1514 is for evaluating methods of determining purity by differential scanning calorimetry. It consists of pure phenacetin and phenacetin doped with p-aminobenzoic acid.

SRM	Type	Unit Size	Melting Temperature (in K)	Enthalpy of Fusion (in J/g)
1514	Thermal Analysis Purity Set	Set of 4 vials: 0.5 g each		*
2220	Tin (99.9995%)	2.5 cm × 2.5 cm × 0.0127 cm	505.10	60.22
2221b	Zinc (99.999%)		In Prep	
2222	Biphenyl (99.984%)	1 g	342.41	120.41
2225	Mercury	2.5 g	234.30	11.469

* Certified for four levels of p-ABA (in mol %).

203. Differential Thermal Analysis (liquid and solid forms)

In cooperation with the International Confederation of Thermal Analysis and Calorimetry (ICTAC), NIST distributes transition point, melting point and magnetic transition measurement Reference Materials (RMs) 8754, 8757, 8758, 8759, 8760, and 8761 for use with differential thermal analyzers, differential scanning calorimeters, and thermogravimetry apparatus. These RMs (except for RM 8754) are configured in sets consisting of four or more materials in varying quantities per unit.

The ICTAC has recently undertaken a complete reevaluation of all the materials comprising these RMs and it is anticipated that the RMs will be redistributed in the future, as single material units rather than in sets. Therefore, only limited quantities of the current RMs are still available. Information about RM status can be obtained by contacting the SRMP Sales Office.

203. Superconductive Thermometric Fixed Point Device

This SRM is composed of six (6) small cylinders of high-purity materials mounted in a threaded copper stud and enclosed in a measuring coil pair. It is intended to provide superconductive fixed points, i.e., temperature of transitions from the normal to the superconductive state.

SRM	Type	Material	Temperature (in K)
767a	Superconductive Thermometric Fixed Point Device	Niobium	9.2
		Lead	7.2
		Indium	3.4
		Aluminum	1.2
		Zinc	0.9
		Cadmium	0.5

203. Defining Fixed Point, International Temperature Scale, ITS-90 (solid forms)

These SRMs are for use in preparing defining fixed points of the International Temperature Scale of 1990 (ITS-90).

SRM	Type	Temperature (in °C)	Unit Size (in g)
740a	Zinc (Freezing Point)	419.527	200, shot
741a	Tin (Freezing Point)		In Prep
743	Mercury (Triple Point)	-38.8344	680, ampule
1744	Aluminum (Freezing Point)	660.323	200, shot
1746	Silver (Freezing Point)	961.78	300, shot

203. Secondary Reference Points (solid forms)

These SRMs are for use in preparing secondary reference-point devices and for calibrating thermometers, thermocouples and other temperature-measuring devices.

SRM	Type	Temperature (in °C)	Unit Size (in g ingot)
45d	Copper (Freezing Point)	1084.8	450
49e	Lead (Freezing Point)	327.45	600
742	Alumina, 99.9 + %	2052	10 (powder)

203. Melting Point and Triple Point (liquid and powder forms)

These SRM fixed point devices are for use in the realization of internationally accepted secondary reference points and/or triple points.

SRM	Type	Temperature (in °C)	Unit Size (in g)
1968	Gallium, 99.9999 + %	29.7646	25, sealed cell
1969	Rubidium, 99.9 + %	39.3	154, sealed cell
1970	Succinonitrile, 99.999 + %	58.0642	60, sealed cell
1971	Indium, 99.9999 + %	156.598	100, sealed cell
1972	1,3-Dioxolan-2-one (Ethylene Carbonate), 99.999 + %	36.3143	60, sealed cell
1973	n-Docosane, 99.999 + %	43.879	60, sealed cell

203. Laboratory Thermometer (mercury in glass)

This thermometer is for use in clinical laboratories. Its main scale extends from 24.00 °C to 38.00 °C, in 0.05 °C divisions. It has an auxiliary scale from -0.20 °C to +0.20 °C.

SRM	Type	Calibrated Points (in °C)	Unit Size
934	Clinical Laboratory Thermometer	0, 25, 30, 37	1 each

203. Thermocouple Material, Platinum (wire form)

SRM	Type	Temperature Range (in °C)	Unit Size
1967	Pt, High Purity (99.999 + %)	197 to 1767	0.051D × 100 cm

203. Vapor Pressure of Metals (rod and wire forms)

SRM	Type	Pressure Range (in Pa)	Temperature Range (in K, ITS-90)	Unit Size (in cm)
745	Gold	10^{-4} to 10^{+2}	1300 to 2100	wire, 0.14 × 15.2
746	Cadmium	10^{-6} to 10^{+1}	350 to 594	rod, 0.64 × 6.4

203. Thermal Conductivity of Graphite and Metals (rod form)

SRM/RM	Type	Unit Size (in cm)	Temperature Range (in K)	Conductivity at 293 K (in W/m/K)
1461	Stainless Steel	1.27D × 5.0	2 to 1200	14.1
1462	Stainless Steel	3.4D × 5.0	2 to 1200	14.1
8420	Electrolytic Iron	0.64D × 5.0	2 to 1000	77.9
8421	Electrolytic Iron	3.17D × 5.0	2 to 1000	77.9
8423	Sintered Tungsten	0.64D × 5.0	2 to 3000	173
8424	Graphite	0.64D × 5.0	5 to 2500	90.9
8425	Graphite	1.27D × 5.0	5 to 2500	90.9
8426	Graphite	2.54D × 5.0	5 to 2500	90.9

203. Thermal Expansion of Glass and Silica (rod form)

SRM	Type	Temperature Range (in K)	Unit Size (in cm)
731	Borosilicate Glass	L1: 80 to 680 L2: 80 to 680 L3: 80 to 680	0.64 × 5.1 0.64 × 10.2 0.64 × 15.2
736	Copper	L1: 20 to 800	0.64 × 5.1
738	Stainless Steel (AISI 446)	293 to 780	0.64 × 5.1
739	Fused Silica	L1: 80 to 1000 L2: 80 to 1000 L3: 80 to 1000	0.64 × 5.1 0.64 × 10.2 0.64 × 15.2

203. Thermal Resistance of Glass and Silica (solid forms)

SRM	Type	Unit Size (in cm)	Temperature Range (in K)	Thermal Resistance (in m ² K/W)
1449	Fumed Silica Board	60 × 60 × 2.54	297.1	1.2
1450b	Fibrous Glass Board	60 × 60 × 2.54	100 to 330	0.75
1452	Fibrous Glass Blanket	60 × 60 × 2.54	297.1	0.60
1459	Fumed Silica Board	30 × 30 × 2.54	297.1	1.2

204. Optical Properties

Molecular Absorption and Molecular Luminescence (film, filter, solid, and solution forms)

The optical SRMs for spectrophotometry are certified transfer standards that fall into three (3) general categories—transmittance, wavelength, and stray radiant energy—each of which addresses a specific instrumental parameter of an ultraviolet/visible absorption spectrometer that must be in control for accurate optical transmittance measurements. To obtain optimum verification results, each SRM must be used within the specified range of conditions for which it is intended.

SRM 930e: This SRM is for the verification and calibration of the transmittance and absorbance scales of visible absorption spectrometers. It differs from the prior series, SRM 930d, only with respect to tightened optical polishing tolerances. SRM 930e has been polished to a parallelism of two arc seconds or better, in such a way so as to reduce the optical deviation (relative to SRM 930d) and improve performance in instruments for which wavelength dispersion occurs *after* the light has passed through the filter. SRM 930e consists of three (3) individual Schott NG-type glass filters in separate metal cuvette-style holders and an empty filter holder. The nominal percent transmittances of the three filters are 10 % T, 20 % T, and 30 % T. The three filters are individually certified for transmittance at five (5) wavelengths in the visible spectrum: 440.0 nm, 465.0 nm, 546.1 nm, 590.0 nm, and 635.0 nm. The optical transmittance neutrality of SRM 930e is sufficient for the filters to be used to accurately verify absorption spectrometers with maximum spectral bandpasses ranging from 2.2 nm to 6.5 nm for the five wavelengths at which the transmittances are certified. When SRM 930e is used in combination with SRM 1930, a 6-point stepwise verification of the transmittance scale is possible over the transmittance range from 1 % T to 50 % T. A detailed discussion of this SRM and SRM 1930 are given in Special Publication 260-116 which accompanies each unit.

SRM 931e: This SRM is for the verification and calibration of the absorbance scales of ultraviolet and visible absorption spectrometers having narrow spectral bandpasses. SRM 931e consists of three (3) sets of four (4) solutions in sealed 10-mL ampules. The four solutions include a blank solution and three concentrations of an empirical inorganic solution prepared from high-purity cobalt and nickel metals dissolved in a mixture of nitric and perchloric acids. The user must transfer the blank and standard solutions to cuvettes of known pathlength. The spectrum has absorption maxima at 302 nm, 395 nm, and 512 nm, and a plateau in the region of 678 nm at which the absorbances are certified. The nominal absorbances of the three empirical inorganic solution standards are 0.3, 0.6 and 0.9, respectively, at wavelengths 302 nm, 395 nm, and 512 nm. At wavelength 678 nm, the nominal absorbances of the three solutions are 0.1, 0.2, and 0.3, respectively. The liquid filters may be used to verify absorption spectrometers with maximum spectral bandpasses ranging from 1.5 nm to 8.5 nm for the four wavelengths at which the absorbances are certified.

SRM 935a: This SRM is for the verification and calibration of the absorbance scales of ultraviolet absorption spectrometers having spectral bandpasses not exceeding 2 nm. Issued in 15-g units, SRM 935a consists of crystalline potassium dichromate of established purity. Solutions of ten (10) known concentrations of this SRM in 0.001 N perchloric acid (between 20 mg/kg and 200 mg/kg) are certified for their specific absorbances under well-defined conditions. The user must prepare the liquid solutions from SRM 935a and then transfer them to cuvettes of known pathlength. The certified specific absorbances for the solutions prepared may be converted to their corresponding reference absorbance values using Beer's Law. Acidic SRM 935a solutions may be prepared anywhere within the concentration range of 20 mg/kg to 200 mg/kg to provide a standard with the desired absorbance at a specified wavelength. The spectrum has absorption maxima at 257 nm and 350 nm, and absorption minima at 235 nm and 313 nm at which the specific absorbance values are certified, and also at 345 nm, near one of the predicted isobestic points of the spectrum. A detailed discussion of this SRM is given in Special Publication 260-54 which accompanies each unit.

SRM 936a: This SRM is for use in the evaluation of methods and the calibration of fluorescence spectrometers. Issued in 1-g units, SRM 936 consists of solid quinine sulfate dihydrate. It is certified for the relative molecular emission spectrum, $E(\lambda)$, in radiometric units for a solution of 1.28×10^{-6} mol/L quinine sulfate dihydrate in 0.105 mol/L perchloric acid using an excitation wavelength of 347.5 nm. The values of the molecular emission spectrum are certified at 5-nm wavelength intervals from 375 nm to 675 nm. The user must prepare the solution and transfer it to a cuvette of known pathlength. A detailed discussion of this SRM is given in Special Publication 260-64.

SRM 1921: This SRM is for use in the calibration of the wavelength scale of spectrometers in the infrared (IR) spectral region from 3 μm to 18 μm (540 cm^{-1} to 3200 cm^{-1}). SRM 1921 consists of five (5) cards made of a matte finish polystyrene film, approximately 38 μm thick with a 25-mm diameter clear aperture and centered 38 mm from the bottom of a cardboard holder 5 cm $\times$ 11 cm $\times$ 2 mm in size. The certified wavelength values, corresponding peak wavenumber values for thirteen (13) absorption peak positions in the 3 μm to 18 μm range and a spectrum marked with arrows identifying the certified peaks, are provided with each unit. A detailed discussion of this SRM is given in Special Publication 260-122.

SRM 1930: This SRM complements SRM 930e for the verification and calibration of the transmittance and absorbance scales of visible absorption spectrometers. SRM 1930 consists of three (3) individual Schott NG-type glass filters in separate metal cuvette-style holders and an empty filter holder. The nominal percent transmittances of the three filters are 1 % T, 3 % T, and 50 % T. The three filters are individually certified for transmittance at five (5) wavelengths in the visible spectrum: 440.0 nm, 465.0 nm, 546.1 nm, 590.0 nm, and 635.0 nm. The optical transmittance neutrality of SRM 1930 is sufficient for the filters to be used to accurately verify absorption spectrometers with maximum spectral bandpasses ranging from 2.2 nm to 6.5 nm for the five wavelengths at which the transmittances are certified. When SRM 1930 is used in combination with SRM 930d, a 6-point stepwise verification of the transmittance scale is possible over the transmittance range from 1 % T to 50 % T. A detailed discussion of this SRM and SRM 930 is given in Special Publication 260-116 which accompanies each unit.

SRM 1931: This SRM is for use in the evaluation and calibration of the relative spectral response of fluorescence spectrometers. It consists of four fluorescence standards and a "blank" specimen mounted in anodized aluminum cuvette-sized holders. The standards are composed of inorganic phosphors in a sintered polytetrafluoroethylene matrix. The fluorescence standards are certified for the relative corrected emission spectrum, $E(\lambda)$, in energy/wavelength units. The values of the blue (400 nm to 550 nm), green (490 nm to 600 nm), yellow (490 nm to 740 nm) and orange (530 nm to 740 nm) emission spectra are certified at 2-nm wavelength intervals. SRM 1931 L and R are oriented for left- and right-handed fluorescence spectrometers, respectively, as defined by viewing the fluorescent sample along the excitation beam. If the first emission optical component is located to the right of the sample then this orientation is designated R, and if it is to the left then it is designated L.

SRM 2030a: This SRM is for use in the one-point verification of the transmittance and absorbance scales of spectrophotometers at the given wavelength and measured transmittance. SRM 2030a consists of one (1) glass filter in its holder and one (1) empty holder. The exposed surface of the glass is approximately 29 mm $\times$ 8 mm, measured from a point 1.5 mm above the base of the filter holder. The filter bears an identification number. The certified transmittance value at a wavelength of 465.0 nm and for a maximum spectral bandpass of 2.7 nm is provided for each unit. The value and uncertainty are unique to each unit and cover a period of two (2) years from date of certification. The uncertainty estimation is described in Special Publication 260-116.

SRM 2031: This SRM is for the verification and calibration of the transmittance and absorbance scales of ultraviolet and visible absorption spectrometers. SRM 2031 consists of three (3) individual non-fluorescent, fused-silica filters in separate metal cuvette-style holders and an empty filter holder. The nominal percent transmittances of the three filters are 10 % T, 30 % T, and 90 % T. The quartz base plates of the 10 % T and 30 % T filters carry different thicknesses of semi-transparent chromium metal that are optically contacted to quartz cover plates. The nominal 90%T filter is a single clear quartz plate. The three filters are individually certified for transmittances at ten (10) wavelengths in the ultraviolet and visible spectral regions: 250.0 nm, 280.0 nm, 340 nm, 360.0 nm, 400.0 nm, 465.0 nm, 500.0 nm, 546.1 nm, 590.0 nm, and 635.0 nm. The optical transmittance neutrality of SRM 2031 is such that wider spectral bandpasses can be used. Consequently, SRM 2031 is the only transmittance SRM that is suitable for use with those absorption spectrometers with large spectral bandpasses, e.g., 8 nm to 20 nm. A detailed discussion of this SRM is given in Special Publication 260-68.

NOTE: Because the 10 % T and 30 % T chromium-coated filters attenuate incident radiation by reflection to a large extent, SRM 2031 may possibly generate interreflections between optical surfaces in the sample compartment of some absorption spectrometers. Such interreflections may result in isochromatic stray radiant energy that affects the accuracy of the transmittance measurement. Consequently, when contemplating the purchase of SRM 2031, the user should contact the instrument manufacturer to verify that metal-on-quartz filters are compatible with the spectrometer.

SRM 2032: This SRM is for use in the assessment of heterochromatic stray radiation energy (stray light) in ultraviolet absorption spectrometers in the spectral region below 260 nm. Issued in 25-g units, SRM 2032 consists of reagent-grade crystalline potassium iodide (KI). Solutions of this SRM in distilled water are certified for their specific absorbances under well-defined conditions at 240 nm, 245 nm, 250 nm, 255 nm, 260 nm, 265 nm, 270 nm, and 275 nm. The KI solutions exhibit sharp cutoffs in transmittances below about 260 nm. The user must prepare a liquid KI solution from SRM 2032 and then transfer it to a cuvette of known pathlength. The certified specific absorbance for the solution prepared is then converted to its corresponding reference transmittance or absorbance value using Beer's Law. The amount of heterochromatic stray light in the absorption spectrometer at a wavelength below 260 nm may be determined from the equations given in the certificate.

SRM 2034: This SRM is for use in the verification and calibration of the wavelength scale of ultraviolet and visible absorption spectrometers having nominal spectral bandwidths not exceeding 3 nm. SRM 2034, a liquid consisting of 4% (w/v) holmium oxide in an aqueous solution of 10% (v/v) perchloric acid, is sealed in a non-fluorescent, fused-silica cuvette of optical quality. SRM 2034 is batch-certified for wavelength location of minimum transmittance of 14 bands in the spectral range from 240 nm to 650 nm for six spectral bandwidths from 0.1 nm to 3 nm. A detailed discussion of this SRM is given in Special Publication 260-102 which accompanies each unit.

SRM	Type	Wavelength Range (in nm)	Unit Size
930e	Glass Filters, Transmittance	440 to 635	3 filters/4 holders
931e	Liquid Filters, Absorbance	302 to 678	Set of 12 ampules
935a	Potassium Dichromate, UV Absorbance	235 to 350	15 g
936a	Quinine Sulfate Dihydrate, Fluorescence	375 to 675	1 g
1921	Infrared Transmission Wavelength	3 μ m to 18 μ m	5 polystyrene cards
1930	Glass Filters, Transmittance	440 to 635	3 filters/4 holders
1931	Fluorescence Corrected Emission Spectra	400 to 760	Set of 4 holders
2030a	Glass Filter, Transmittance	465.0	1 filter/1 holder
2031	Metal-on-Quartz Filters, Transmittance	250 to 635	In Prep
2032	Potassium Iodide, Stray Light	240 to 280	25 g
2034	Holmium-oxide Solution, Wavelength	240 to 650	1 sealed cuvette

204. Specular Spectral Reflectance (plate form)

These SRMs are for calibrating the reflectance scale of integrating sphere reflectometers used to evaluate materials for solar energy collectors and to calibrate reflectometers used in evaluating the appearance of polished metals and metal-plated objects.

SRM	Type	Wavelength Range (in nm)	Unit Size (in cm)
2003	First Surface, Aluminum on Glass	250 to 2500	In Prep
2011	First Surface, Gold on Glass	600 to 2500	5.1D × 1.2
2023	Second Surface, Aluminum on Fused Quartz	250 to 2500	5.1D × 0.6
2026	First Surface, Black Glass	250 to 2500	5.1D × 0.6

204. Infrared Reflectance (solid form)

This SRM is for establishing the accuracy of the near infrared (IR) wavelength scale of reflectance spectrophotometers.

SRM	Type	Wavelength Range (in nm)	Unit Size (in cm)
1920	Rare Earth Oxide Mixture	740 to 2000	holder: 5.1D × 1.2

204. Directional Hemispherical Reflectance (wafer form)

SRM	Type	Wavelength Range (in nm)	Unit Size (in cm)
2015	Opal Glass	400 to 750	2.5 × 5.0 × 0.64

204. Optical Rotation (powder form)

These SRMs are for calibrating or checking polarimetric apparatus. In aqueous solution, the optical rotation of SRM 17d is certified at three (3) wavelengths, while that of SRM 41c is certified at two (2) wavelengths. SRM 41c is also certified at one (1) wavelength in a dimethyl sulfoxide solution.

SRM	Type	Optical Rotation (in mrad) – Aqueous Solution Wavelength (in nm)			Unit Size (in g)
		546	589	633	
17d	Sucrose	711.64	604.26	519.17	60
41c	Dextrose	1101.1	931.8	798.6	70

204. Photography (chart form)

SRM 1010a is used to test the resolving power of cameras or of whole microcopying systems. It consists of five (5) charts printed photographically on paper, which have 26 high-contrast, 5-line patterns ranging in spatial frequency from one cycle per mm to 18 cycles per mm. Instructions for the use of the charts are supplied with each unit.

SRM	Type	Unit Size
1010a	Microcopy Resolution Test Chart	Set of 5 charts

205. Radioactivity

Radiation Dosimetry (wire form)

This SRM is a cobalt-in-aluminum alloy wire 0.5 mm in diameter and 1 m in length for use as a neutron density monitor standard.

SRM	Type	Cobalt Composition (in Wt. %)
953	Neutron density monitor wire (Co in Al)	0.116

Fission Track Glass (wafer form)

This SRM, which contains uranium, will aid laboratories performing fission track analyses in interlaboratory comparisons of data and in monitoring neutron fluences. The material was irradiated in the NIST 10 Megawatt Research Reactor, at two different neutron energies. Each unit consists of four (4) unirradiated glass wafers and two (2) irradiated wafers.

SRM	Uranium Composition (in mg/kg)	Uranium-235 (in Atom %)	Reactor Position	Neutron Fluence Copper Foil	Gold Foil
963a	0.823	0.2792	RT-4: RT-3: (10^{14} n/cm ²)	39.5 41.2	43.0 45.8

205. Special Nuclear Materials

The U.S. Department of Energy New Brunswick Laboratory issues special nuclear reference materials as NBL Certified Reference Materials (CRMs). These CRMs include the plutonium and uranium assay and isotopic materials previously issued by the National Institute of Standards and Technology. All orders or inquiries should be addressed to: U.S. Department of Energy, New Brunswick Laboratory, 9800 S. Cass Avenue, Bldg. 350, Argonne, IL 60439-4899. Attn: Reference Materials Sales; Phone - (708) 252-2767; Fax - (708) 252-6256; TWX/Telex - 681701DOEANL

The SRMs in the following five pages are certified and distributed for the SRM Program by the NIST Radioactivity Group. The radionuclide types represented by these SRMs are suitable for a variety of measurement and instrument calibration needs. Detailed information about the Radioactivity SRMs and a form for license certification can be found in a separate catalog issued periodically by the Radioactivity Group. Inquiries about NIST Radioactivity SRMs or requests for copies of the Radioactivity catalog should be directed to the **Radioactivity Group, Ionizing Radiation Division, Room C114, Radiation Physics Building, National Institute of Standards and Technology, Gaithersburg, MD 20899, Phone: (301) 975-5531; Fax: (301) 926-7416.**

Requests for new or renewal SRMs can be submitted to the Radioactivity Group. Upon receipt, these requests are evaluated and interested customers are notified whether or not the SRMs can be made available.

NOTE: Certain radionuclides are not economical to maintain as SRMs because of short half lives or low customer demand.

NIST Special Publication 250, *Calibration Services Users Guide*, describes the procedure for requesting calibration of radionuclides not provided as SRMs. Requests for such tests should also be submitted, with full source information for approval of suitability, to the Radioactivity Group at the above address.

205. Radioactive Solutions

These SRMs are intended for the calibration of radioactivity-measuring instruments and for the monitoring of chemical and geochemical processes. They are calibrated in terms of activity per gram of solution. Each SRM is contained in a flame-sealed glass ampule or bottle and, except as noted, consists of the radionuclide dissolved in an aqueous solution (usually acidic).

SRM	Radionuclide	Decay Modes	Activity per gram (in Bq · g ⁻¹)	Time of Calibration (month/year)	Volume of Solution (mL)
4322B*	Americium-241	α	40	09/91	5
4332D*	Americium-243	α	40	12/94	5
4251C*	Barium-133	EC, γ	500 000	09/93	5
4222C	Carbon-14 (as hexadene)	β ⁻	50 000	09/90	5
4233C*	Cesium-137 Burn-up Standard	β ⁻ , γ	700 000	11/89	5
4943	Chlorine-36	β ⁻	10 000	12/84	3
4915E*	Cobalt-60	β ⁻ , γ	80 000	12/94	5
4329*	Curium-243	α	60	04/89	5
4320*	Curium-244	α	60	04/89	5
4370C*	Europium-152	β ⁻ , EC, γ	90 000	02/87	5
4361B	Hydrogen-3 (as water)	β ⁻	1	08/87	490
4926D	Hydrogen-3 (as water)	β ⁻	3 000	07/89	18
4927E	Hydrogen-3 (as water)	β ⁻	500 000	07/91	3
4947C	Hydrogen-3 (as toluene)	β ⁻	300 000	03/87	4
4949C*	Iodine-129	β ⁻ , γ	3 000	03/93	5
4929D	Iron-55	EC	40 000	08/85	5
4341*	Neptunium-237	α	100	03/94	5
4226C*	Nickel-63	β ⁻	1 000 000	In Prep	5
4326	Polonium-209	α, EC	90	03/94	5
4323A*	Plutonium-238	α	30	02/94	5
4338*	Plutonium-240	α	20	04/80	5
4340*	Plutonium-241	β ⁻	150	07/86	5
4334E*	Plutonium-242	α	25	12/89	5
4952C	Radium-226 Blank	—	0.000 2	08/91	5
4950E	Radium-226	α, γ	3	04/84	5
4965	Radium-226	α, γ	30	09/91	5
4966	Radium-226	α, γ	300	09/91	5
4967	Radium-226	α, γ	3 000	09/91	5
4339A	Radium-228	β ⁻	200	04/94	5
4919G*	Strontium-90	β ⁻	4 000	08/90	5
4234A*	Strontium-90	β ⁻	2 000 000	10/94	5
4288A	Technetium-99	β ⁻	40 000	12/94	5
4328A	Thorium-229	α	30	01/94	5
4324A	Uranium-232	α	40	11/93	5
4321B	Uranium-238 "natural uranium"	α	250	01/92	5
4276C*	Long-Lived Mixed Radionuclide:			09/88	5
	Antimony-125	β ⁻ , γ	10 000		
	Europium-154	β ⁻ , γ	10 000		
	Europium-155	β ⁻ , γ	7 000		

* License certification is required of purchaser by NIST before shipment.

205. Radiopharmaceuticals (solution and gaseous forms)

These SRMs are intended for the calibration of radioactivity-measuring instruments. They are calibrated in terms of activity per gram of solution (except SRM 4415, which is calibrated in terms of activity). Each SRM is contained in a 5 mL flame-sealed glass ampule and, except for SRM 4415, consists of the radio-nuclide dissolved in an aqueous solution (usually acidic).

These SRMs are produced in collaboration with the Nuclear Energy Institute and, because of the short half lives, are available only at specific times. For the current production schedule contact the Radioactivity Group at the address given on page 107.

SRM	Radionuclide	Half Life (days)	Activity per gram (MBq · g ⁻¹)
4400N*	Chromium-51	27.7	4
4408D*	Cobalt-57	271.7	2
4416O*	Gallium-67	3.3	4
4421L*	Gold-195	183	1
4405B*	Gold-198	2.7	4
4417N*	Indium-111	2.8	5
4414C*	Iodine-123	0.6	60
4407S*	Iodine-125	59.6	1
4401T*	Iodine-131	8.0	5
4411B*	Iron-59	44.5	1
4420B*	Lead-203	2.2	3
4418L*	Mercury-203	46.6	1
4412S*	Molybdenum-99/Techetium-99m	2.7	10
4406M*	Phosphorus-32	14.3	2
4425A*	Samarium-153	1.9	4
4409D*	Selenium-75	119.8	1
4403B*	Strontium-85	64.9	1
4426A*	Strontium-89	50.0	1
4424*	Sulfur-35	87.4	1
4410HT*	Techetium-99m	0.3	1 000
4404Q*	Thallium-201	3.0	4
4402C*	Tin-113/Indium-113	115.1	1
4415R*	Xenon-133	5.2	Total 500
4419C*	Ytterbium-169	32.0	2
4427A*	Yttrium-90	2.7	1

* License certification is required of purchaser by NIST before shipment.

205. Alpha Particle Point Sources

These SRMs are intended for the calibration of alpha-particle detectors. Each SRM consists of a practically weightless deposit of the radionuclide electroplated on a thin platinum foil cemented to a monel disk.

SRM	Radionuclide	Principal Alpha Energies (MeV)	Activity (Bq)	Time of Calibration (month/year)
4904NG*	Americium-241	5.443, 5.486	2 000 to 7 000	05/86
4904SG*	Americium-241	5.443, 5.486	2 000 to 3 000	05/86
4906C*	Plutonium-238	5.456, 5.499	10 to 300	09/87
4906HC*	Plutonium-238	5.456, 5.499	1 000 to 50 000	10/87

* License certification is required of purchaser by NIST before shipment.

205. Carbon-14 Dating (solid form)

This SRM is an international standard for contemporary carbon-14 against which world-wide measurements can be compared. Each SRM consists of approximately 225 grams of a 450-kg lot of oxalic acid prepared by fermentation of French beet molasses from the 1977 spring, summer, and autumn harvests.

SRM	Material	Description
4990C	Oxalic Acid	Set of 8; 28 g each

205. Accelerator Mass Spectrometry (solution form)

This SRM is intended for the calibration of accelerator mass spectrometers used to measure beryllium isotopic ratios. It is calibrated in terms of the isotopic ratio. The SRM is contained in a flame-sealed glass ampule and consists of the nuclides dissolved in an aqueous solution (acidic).

SRM	Nuclides	Isotopic Ratio	Total Nuclide Concentration ($\text{mg} \cdot \text{g}^{-1}$)	Time of Calibration (month/year)	Volume of Solution (mL)
4235	Beryllium-10/Beryllium-9	3×10^{-11}	5	08/86	50

* License certification is required by NIST.

205. Gamma Ray Point Sources

These SRMs are intended for the calibration of gamma-ray detectors. Each SRM consists of a small deposit of radioactive material sealed between two layers of polyester tape that are mounted on an aluminum annulus.

SRM	Radionuclide	Principal Photon Energies (keV)	Activity (Bq)	Time of Calibration (month/year)
4241B*	Barium-133	81 to 384	200 000	06/81
4200B	Cesium-137/Barium-137m	662	40 000	09/79
4207B	Cesium-137/Barium-137m	662	300 000	03/87
4203D*	Cobalt-60	1173, 1332	20 000 to 800 000	02/84
4201B	Niobium-94	702, 871	4 000	04/70
4275C	Long-Lived Mixed Radionuclide: Antimony-125 Europium-154 Europium-155	27 to 1596	50 000 60 000 30 000	09/88

* License certification is required of purchaser by NIST before shipment.

205. Radon Emanation (encapsulated solution form)

This SRM is intended for the calibration of radon-222 measuring instruments. It consists of a small heat-sealed polyethylene cylinder containing approximately 0.35 grams of radium-226 solution. The SRM is calibrated in terms of the radium-226 activity and in terms of the emanation fraction of the radon-222 under specified conditions.

SRM	Radionuclide	Activity (Bq)	Time of Calibration (month/year)
4968	Radium-226	3 to 500	09/91

205. Natural Matrix Materials (powder form)

SRM 4350B—Columbia River Sediment

This material was collected from a river downstream from a nuclear reactor facility. Concentrations of fission and activation products are elevated over typical world-wide levels. $^{239/240}\text{Pu}$ and ^{241}Am are very homogeneously distributed through the sample and are in acid-leachable forms. Inhomogeneity is 3% or better for other radionuclides.

SRM 4351—Human Lung

This material contains radioactivity concentrations on the order of $10^{-4} \text{ Bq g}^{-1}$. It has been freeze-dried, cryogenically ground, homogenized, and packed in a glass bottle under vacuum. There is significant inhomogeneity in $^{239/240}\text{Pu}$ which is unavoidable because plutonium was taken into the lungs in particulate form. Assessments of accuracy of measurement techniques can be improved by averaging over several samples.

SRM 4352—Human Liver

This material contains radioactivity concentrations on the order of $10^{-4} \text{ Bq g}^{-1}$. It has been freeze-dried, cryogenically ground, homogenized, and packed in a glass bottle under vacuum.

SRM 4353—Rocky Flats Soil Number 1

This material was collected within 13 cm of the soil surface at Rocky Flats, CO. $^{239/240}\text{Pu}$ and ^{240}Am concentrations are about an order of magnitude higher than typical world-wide levels. Approximately 10% of the plutonium is in an acid-resistant form. The material also contains "hot" particles and a statistical method is provided for dealing with these. Inhomogeneities, excluding hot particles, are on the order of 3% or better.

SRM 4354—Freshwater Lake Sediment

This material (gyttja) contains approximately 25 g of freeze-dried, pulverized freshwater lake sediment (approximately 50% organic by weight) in a polyethylene bottle. The SRM is intended for use in tests of measurements of environmental radioactivity contained in matrices similar to the sample, for evaluating analytical methods, or as a generally available calibrated "real" sample matrix in interlaboratory comparisons.

SRM 4355—Peruvian Soil

This material, provided in 75 g units, has non-measurable radioactivity concentrations for many fallout radionuclides and can be used as a blank or for sensitive tests of radioanalytical procedures at low-radioactivity concentrations for other radionuclides. The results of a trace-element study are given for 57 elements.

SRM 4357—Ocean Sediment In Prep

This SRM, provided in 80-g units, consists of sediments collected in the Chesapeake Bay and in the sea off of the British Nuclear Fuels Sellafield facility in the United Kingdom. The material, which has been freeze-dried, pulverized, homogenized, and radiation-sterilized, is intended for use in tests of low-level radiochemical methods for measurement of such fission products as ^{90}Sr and ^{137}Cs and actinides such as ^{232}Th , ^{238}U , and $^{239/240}\text{Pu}$.

206. Electrical Properties

Electrical Resistivity and Conductivity of Metals (rod form)

These materials are for evaluating methods of measuring electrical resistivity over wide temperature ranges.

SRM/RM	Type	Temperature Range (in K)	Resistivity at 293 K (in $\mu\Omega \cdot \text{cm}$)	Unit Size (in cm)
1461	Stainless Steel	5 to 1200	80.5	rod: 1.27D $\times$ 5.0
1462	Stainless Steel	5 to 1200	80.5	rod: 3.40D $\times$ 5.0
8420	Electrolytic Iron	6 to 1000	10.1	rod: 0.64D $\times$ 5.0
8421	Electrolytic Iron	6 to 1000	10.1	rod: 3.17D $\times$ 5.0
8423	Sintered Tungsten	4 to 3000	5.4	rod: 0.64D $\times$ 5.0

206. Electrical Resistivity and Conductivity of Silicon (block and wafer forms)

SRMs 1521 and 1523 are sets of two wafers each, intended primarily for use as reference standards for measuring semiconductor resistivity and eddy current. SRMs 2526, 2527, 2528, and 2529 are sets of 16 silicon chips, each mounted on beveling blocks, intended to provide a number of resistivity-scale reference points for calibrating spreading resistance measurements of (111) p-type and n-type (SRMs 2526 and 2527) and (100) p-type and n-type (SRMs 2528 and 2529) silicon. SRMs 2541 through 2547 consist of single wafers, intended for use as reference standards for sheet resistance and resistivity measurements utilizing the four-point probe method. Each wafer is made of Czochralski-grown, boron-doped silicon with a (100) crystallographic orientation.

SRM	Type	Resistivity (in $\Omega \cdot \text{cm}$)	Unit Size (in mm)
1521	Silicon Resistivity	0.1 and 10	Set of 2: 51D $\times$ 0.63
1523	Silicon Resistivity	0.01 and 1.0	Set of 2: 51D $\times$ 0.63
2526	Spreading Resistance	0.001 to 200	Set of 16: 5 $\times$ 10 $\times$ 0.625
2527	Spreading Resistance	0.001 to 200	Set of 16: 5 $\times$ 10 $\times$ 0.625
2528	Spreading Resistance	0.001 to 200	Set of 16: 5 $\times$ 10 $\times$ 0.625
2529	Spreading Resistance	0.001 to 200	Set of 16: 5 $\times$ 10 $\times$ 0.625
2541	Silicon Resistivity	0.01	100D $\times$ 0.625
2542	Silicon Resistivity	0.1	100D $\times$ 0.625
2543	Silicon Resistivity	1	100D $\times$ 0.625
2544	Silicon Resistivity	10	100D $\times$ 0.625
2545	Silicon Resistivity	25	100D $\times$ 0.625
2546	Silicon Resistivity	100	100D $\times$ 0.625
2547	Silicon Resistivity	200	100D $\times$ 0.625

206. Residual Resistivity Ratio (rod form)

This SRM is a set of five (5) aluminum rods for use in checking four-terminal dc and eddy current decay techniques. The residual resistivity ratio (RRR), $\rho(273\text{ K})/\rho(4\text{ K})$, is a sensitive indicator of purity and of the mechanical state of a material.

SRM	Type	RRR Values	Unit Size (in cm)
769	Aluminum	130, 683, 1205, 2650, and 11,000	0.64D × 5.2

206. Superconducting Critical Current (wire form)

This SRM is for checking the performance of measurement systems used in superconductor technology. It consists of 2.2 m of a multifilamentary niobium titanium, copper-stabilized superconducting wire wound in a single layer onto a spool with a core diameter of 8.7 cm.

SRM	Type	Magnetic Field (in T)	Critical Current (in A)
1457	Nb-Ti Wire	2.000	293.30
		4.000	187.38
		6.000	124.72
		8.000	69.72

207. Metrology

Scanning Electron Microscope (SEM)

These SRMs are for calibrating the magnification scale and evaluating the performance of scanning electron microscopes. SRM 484g, on a 6.5-mm specimen mount, can be used to calibrate the magnification scale of an SEM from 1000 to 20,000 X. SRM 2069b consists of graphitized rayon fibers with smooth and uniform edges on a 3-mm SEM specimen mount. SRM 2090 will consist of a silicon chip on a silicon-wafer simulating mount and is being developed to meet the SEM needs of the semiconductor industry.

SRM	Type	Spacings	Size
484g	SEM Magnification Standard	0.5 to 5 μm	In Prep
2069b	SEM Performance Standard	2 to 4 mm	12 mm D
2090	SEM Magnification Standard	>0.5, >10 μm	In Prep

207. Optical Microscope Linewidth Measurement (wafer form)

These SRMs are for use in calibrating optical microscopes used to measure the widths of opaque lines and clear spaces on integrated-circuit photomasks. They can also be used to calibrate line spacings and line-to-space ratios. They are not for use with partially transmitting materials, in reflected light with opaque materials, or in a scanning electron microscope. SRMs 473 and 475 are patterned on antireflecting chromium; SRM 476 is patterned on bright chromium.

SRM	Type	Spacings (in μm)	Unit Size (in cm)
473	Linewidth Measurement Standard	2 to 70	$12.7 \times 12.7 \times 0.23$
475	Linewidth Measurement Standard	2 to 36	$6.35 \times 6.35 \times 0.15$
476	Linewidth Measurement Standard	0.5 to 12	$6.35 \times 6.35 \times 0.15$

207. Depth Profiling (wafer form)

SRMs 2135c and 2136 are for calibrating equipment used to measure sputtered depth and erosion rates in surface analysis. SRM 2135c will be certified for total chromium and total nickel thickness, for individual layer uniformity, for Ni/Cr bi-layer uniformity, and for individual layer thickness. SRM 2136 is certified for total Cr thickness of seven individual layer thicknesses. SRM 2137 is for calibrating the secondary ion response to minor and trace levels of boron in a silicon matrix.

SRM	Type	Value	Unit/Size (in cm)
2135c	Ni-Cr Thin-Film Depth Profile Standard	In Prep	$1 \times 2.54 \times 0.04$
2136	Cr/CrO Thin-Film Depth Profile Standard	$175.3 \mu\text{m}/\text{cm}^2$	$1 \times 2.54 \times 0.04$
2137	B Implant in Si Depth Profile Standard	$^{10}\text{B} - 1.018 \times 10^{15} \text{ atoms}/\text{cm}^2$	1×1

207. Optical Fiber Geometry (solid form)

SRM 2520 is intended for calibrating video microscopes or gray-scale systems used for fiber geometry measurements during fiber manufacture. It consists of a short length of bare fiber in an aluminum housing. The end of the fiber specimen has been carefully cleaved and is within approximately one-half wavelength of perpendicularity to the axis of the fiber. The diameter of each specimen is individually certified at 0, 45, 90, and 135 degree angles.

SRM	Type	Certified Diameter
2520	Optical Fiber Diameter	125 μm

207. Copper and Chromium Coating on Steel (plate form)

These SRMs are used to measure the thickness of nonmagnetic coatings on steel. The steel substrates have the properties of AISI 1010 steel and may be used to measure the thickness of paint and other organic coatings on steel, as well as zinc (galvanized) and other nonmagnetic metallic coatings.

SRM	Unit Size 30×30 mm	Coating Thickness, nominal	
		(in mils)	(in μm)
1357	Set of 3	0.2, 0.8, 2.0	base, 6, 20, 48
1358	Set of 3	3.1, 9.8, 39	base, 80, 225, 1000
1359	Set of 4	2.0, 5.5, 20, 32	48, 140, 505, 800
1360	Set of 4	0.1, 0.2, 0.5, 0.8	2.5, 6, 12, 20
1361a	Set of 4	0.2, 0.5, 1.0, 2.0	6, 12, 25, 48
1362a	Set of 4	1.6, 3.1, 5.5, 7.9	40, 80, 140, 205
1363a	Set of 4	9.8, 16, 20, 26	255, 385, 505, 635
1364a	Set of 4	32, 39, 59, 79	800, 1000, 1525, 1935

207. Solder Thickness (plate form)

This SRM is for calibrating X-ray fluorescence equipment. Each unit, which consists of a 1.5 cm × 1.5 cm plate of an electroplated tin-lead alloy coating on a copper substrate, is individually certified for composition and mass per unit area.

SRM	Type	Composition	Coating Thickness, nominal	
			(in μin)	(in μm)
2321	Sn-Pb Alloy	Sn: 40 Pb: 40	295	7.5

207. Gold Coating on Fe-Ni-Co Alloy (plate form)

SRM	Unit Size 15×15 mm	Coating Mass (in mg/cm^2)	Coating Thickness, nominal	
			(in μin)	(in μm)
1371	1 each	1.5	30	0.8
1373	1 each	6.0	120	3
1374	1 each	14.0	280	7

207. Ellipsometry (wafer form)

These SRMs are issued primarily to evaluate the accuracy of ellipsometers and can also be used as an aid in the calibration of various other optical thickness-monitoring instruments. Each unit is certified for the ellipsometric parameters delta (Δ) and psi (Ψ) at the vacuum wavelength $\lambda = 633.0$ nm, and for the derived values of the thicknesses and indices of refraction of the SiO_2 and Si layers.

SRM	Type	Unit Size 76 mm D	Thickness (in nm)
2531	Thin Film Thickness	1 each	50
2532	Thin Film Thickness	1 each	100
2533	Thin Film Thickness	1 each	200
2534	Thin Film Thickness	1 each	25
2535	Thin Film Thickness	1 each	14
2536	Thin Film Thickness	1 each	10

207. Oxygen Concentration in Silicon (wafer form)

SRM 2551 is for the calibration of infrared spectrophotometers used to measure the 1107 cm^{-1} interstitial oxygen peak in silicon. Each unit is individually certified and consists of a set of three silicon wafers; one each of a low, medium and high oxygen level Czochralski specimen. A float zone specimen of minimum oxygen concentration is also included in each set. Certified values are provided in ppma, mg/kg and atoms/cm.

SRM	Type	Unit Size (in cm)	Concentration (in mg/kg, nominal)
2551	Oxygen in Silicon	Set: 4×2.5	L - 10 M - 13 H - 15 FZ - (<0.1)

207. NIST Time Software

The NIST Automated Time Service (ACTS) is a telephone time service designed to provide computers with telephone access to NIST time at occurrences approaching 1 millisecond (0.001 s). Features of the service include automated compensation for telephone-line delay, advanced alert for changes to and from daylight savings time and advanced notice of insertion of leap seconds. The ASCII-character time code should operate with standard modems and most computer systems. While the system can be used to set up computer time-of-day, simple hardware can be developed to set non-computer clock systems. The telephone number for ACTS is (303) 494-4774.

SRM	Type	Unit Size
8101a	Automated Computer Time Service (ACTS)	13.34 cm diskette

208. Ceramics and Glasses

Chemical Resistance [Durability] of Glass (solid form)

These SRMs are for checking test methods and calibrating equipment used to determine the resistance of glass containers to chemical attack. The values given represent the volume of 0.02 N sulfuric acid used to titrate to the methyl-red end point the alkaline extract from a crushed sample of glass after exposure to high-purity water at 121 °C.

SRM	Type	Unit Size	mL of N/50 H ₂ SO ₄
622	Soda-Lime Silica	2.2 kg	7.67
623	Borosilicate	2.2 kg	0.34

208. Electrical Properties of Glass (bar and powder forms)

SRM 624 is for checking test methods and for calibrating equipment used to determine the dc volume resistivity of glass per ASTM C 657. SRM 774 is for checking methods used to determine dielectric constant and ac loss characteristics of insulating materials per ASTM D 150.

SRM	Type	Unit Size (in cm)	Value
624	Lead-Silica, for dc resistivity	5 × 5 × 0.5	log ₁₀ ρ ~ 9.9 Ω-cm at 300 °C
774	Lead-Silica, for dielectric constant	5 × 5 × 2.5	K ~ 7.47 at 100 Hz
1414	Lead-Silica, for resistivity (molten range)	4 × 4 × 12	13.5 Ω-cm at 1300 °C

208. Viscosity of Glass (bar form)

SRMs 710a, 711, and 717a are for checking the performance of high-temperature viscosity equipment (rotating cylinders) and low-temperature viscosity equipment (fiber elongation, beam bending, parallel plates, etc.).

SRM	Type	Temperature (°C) at Log 10 Viscosity (in Pa · s*)										
		1	2	3	4	5	6	7	8	9	10	11
710a	Soda-Lime-Silica	1464	1205	1037	918							
711	Lead-Silica	1327.1	1072.8	909.0	794.7	710.4	645.6	594.3	552.7	518.2	489.2	464.5
717a	Borosilicate	1555.4	1256.5	1065.1	932.1							

* SI unit. Replaces term, "poise". (Pa · s = poise × 10⁻¹)

208. Viscosity Fixpoints (solid forms)

These SRMs are for the calibration of equipment for the determination of the softening, annealing, and strain points of glass.

SRM	Type	Unit Size	Softening Point, °C	Annealing Point, °C	Strain Point, °C
709	Extra Dense Lead	4 cm × 4 cm × 5 cm	384	328	311
710a	Soda-Lime-Silica	10 cm × 10 cm × 4 cm	730.6	(545)	(504)
711	Lead-Silica	4 cm × 4 cm × 12 cm	602	432	392
712	Mixed Alkali Lead Silicate	225 g	528	386	352
713	Dense Barium Crown 620/603	225 g	738	631	599
714	Alkaline Earth Alumina Silicate	225 g	908	710	662
716	Neutral	250 g	794	574	530
717	Borosilicate	4.2 cm × 4.2 cm × 12.5 cm	719	513	470

208. Relative Stress Optical Coefficient (bar form)

This glass is for calibrating instruments used to measure relative stress optical coefficient of glass.

SRM	Type	Unit Size	Relative Stress Optical Coefficient (C) at $\lambda=546.1$ nm (Value × 10^{-12} m ² /N)
709	Extra Dense Lead	4 cm × 4 cm × 5 cm	C = -1.359

208. Glass Liquidus Temperature (solid form)

These SRMs are for checking test methods and for calibrating equipment used to determine the liquidus temperature of glass by the gradient furnace methods per ASTM C 829.

SRM	Type	Unit Size	Method	Temperature, °C
773	Soda-Lime-Silica	2.5 cm × 2.5 cm × 0.6 cm	A (boat)	988
			B (perforated plate)	991
1416	Aluminosilicate	22 pieces tubing (250 g)	A (boat)	1147

209. Miscellaneous Properties

209. X-ray Diffraction (powder and solid forms)

SRMs 656, 676, 674a, 1878a, and 1879a consist of high phase purity materials for use in the quantitative analysis of samples by the internal standard method. SRM 656, a silicon nitride, is certified for both α and β polymorphs. SRMs 640b, 660, 675, and 1976 consist of materials with select crystallographic and microstructure properties used in the evaluation of diffraction equipment for the following variables; 1) d-spacing or line position, 2) line or instrument intensity, and 3) instrumental or sample contributions to the shape of reflection profiles. SRM 1976, a sintered alumina plate, is also certified with respect to lattice parameters as well as 12 relative intensity values from 25 to 145 degrees 2θ (Cu K_α).

SRM	Type	XRD Application	Lattice Parameters (in nm)	Unit Size (in g)
640b	Silicon Powder $2\theta/d$ -Spacing	Line Position	0.5430940	7.5
656	Silicon Nitride	Quantitative Analysis	α -(0.7752630/0.5619372) β -(0.7602293/0.2906827)	10 10
660	LaB ₆ - 2θ	Line Profile	0.415695	3
674a	Powder Diffraction Intensity	Quantitative Analysis		
	α -Al ₂ O ₃ (corundum)		(0.4759397/1.299237)	10
	CeO ₂ (fluorite)		(0.5411102)	10
	Cr ₂ O ₃ (corundum)		(0.4959610/1.358747)	10
	TiO ₂ (rutile)		(0.4593939/0.2958862)	10
	ZnO (wurtzite)		(0.3249074/0.5206535)	10
675	Mica Low 2θ	Line Position	0.998104	7.5
676	Alumina (corundum)	Quantitative Analysis	0.475919/1.299183	20
1976	Alumina Plate, Sintered	Instrument Sensitivity	0.4758846/1.299306	4.5 cm $\times$ 0.16 cm

Values in parentheses are not certified and are given for information only.

209. X-ray Diffraction of Ferrous Materials (disk and wafer forms)

SRMs 487 and 488 are for calibrating X-ray diffraction equipment used in determining the amount of retained austenite in ferrous materials. SRM 493 is for calibrating X-ray diffraction and Mössbauer equipment to determine the relative amounts of iron carbide in steel.

SRM	Type	Unit Size (in cm)
487	Austenite in Ferrite 30%	disk: 2.1D $\times$ 0.24
488	Austenite in Ferrite 2.5%	disk: 2.1D $\times$ 0.24

209. X-ray Stage Calibration (solid forms)

These SRMs are to be used to check the dimensional accuracy of x-ray inspection systems.

SRM	Type	Unit Size (in mm)
1842	Calibration Board (X and Y dimensions)	Board: 300 $\times$ 300 $\times$ 3
1843	Calibration Specimen (Z dimension)	Triangular Block: 37 $\times$ 20 $\times$ 12

209. Density and Refractive Index (liquid and solid forms)

These SRMs are for reference in the determination of the density of liquids and solids. The certified densities of SRM 211d was measured with a special-design picnometer; the certified refractive indexes were measured with a precision spectrometer. The certified densities of SRMs 1826 and 1827 were determined by means of hydrostatic weighing.

SRM	Type	Unit Size	Density* (in g/cm ³)	Refractive Index **
211d	Toluene	5-mL ampule	In Prep	
1820	Borosilicate Glass	slab – 3.8 cm × 3.8 cm × 0.6 cm	(2.292)	1.48669
1822	Soda-Lime Glass	slab – 3.8 cm × 3.8 cm × 0.6 cm		1.52876
1826	Soda-Lime Glass	button – 3.20 cm × 1.3 cm	2.549382	
1827	Lead Silica Glass	slab – 0.6 cm × 4.0 cm × 2.5 cm	3.04948	

* Values are at 25 °C.

** Values are at 20 °C and 435.83 nm (mercury spectral source).

Values in parentheses are not certified and are given for information only.

209. Bleached Kraft Pulps (sheet form)

These Reference Materials, RMs 8495 Northern Softwood Bleached Kraft Pulp and 8496 Eucalyptus Hardwood Bleached Kraft Pulp, are intended primarily for use in fundamental studies on the physical properties of fibers and paper sheets. The materials selected for these two RMs are bleached dried lap pulp, each from a single lot of a standard commercial production run. The materials were selected because of their differing fiber size, differing papermaking properties, and similarity to commercially available materials.

RMs 8495 and 8496 were developed and prepared with input and support from the Pulp Material Research Committee (PMRC), a sub-committee of the Fundamental Research Committee. These materials were donated by industry and are being distributed by the Standard Reference Materials Program. At this time, no extensive property measurements have been made on these materials beyond ensuring they were within the control limits of the normal production run. A measurement error study is in progress with participation by international paper technical laboratories. As results become available, they will be published and added to the Report of Investigation that accompanies each of these materials.

RM	Type	Unit Size
8495	Northern Softwood	10 standard lap sheets × 0.5 kg
8496	Eucalyptus Hardwood	10 standard lap sheets × 0.5 kg

Engineering Materials



Standard Reference Materials

for

Engineering Materials

301. Sizing

Particle Size (powder and solid forms)

These SRMs are for evaluating and calibrating various type of particle size measuring instruments, including light and electrical zone flow-through counters, optical and electron microscopes, sedigraphs, and wire cloth sieving devices. SRM 659 consists of equiaxed silicon nitride primary particles with a minimal amount of large agglomerates; SRM 1978 consists of granular, irregular-shaped zirconium oxide primary particles with a minimal amount of large agglomerates. SRMs 1003b, 1004a, 1017b, 1018b and 1019a each consist of soda-lime glass beads covering a particular size distribution range. SRMs 1690, 1691, 1692 and 1963 are commercially-manufactured latex particles in a water suspension. SRMs 1960 and 1961 (also called 'space beads') are latex particles produced by the National Aeronautics and Space Administration (NASA) during the Challenger STS-6 and STS-11 missions, respectively. SRM 1965 consists of two different groupings of the SRM 1960 particles.

SRM	Type	Particle Size (in μm)	Unit Size
659	Silicon Nitride	0.2 to 10	5 vials: 2.5 g each
1003b	Glass	10 to 60	25 g
1004a	Glass	40 to 170	70 g
1017b	Glass	100 to 310 nominal	In Prep
1018b	Glass	225 to 780 nominal	In Prep
1019a	Glass	760 to 2160	200 g
1690	Polystyrene (0.5 Wt. % in H_2O)	0.895	5-mL vial
1691	Polystyrene (0.5 Wt. % in H_2O)	0.269	5-mL vial
1692	Polystyrene (0.25 Wt. % in H_2O)	2.982	5-mL vial
1960	Polystyrene (0.4 Wt. % in H_2O)	9.89	5-mL vial
1961	Polystyrene (0.5 Wt. % in H_2O)	29.64	5-mL vial
1963	Polystyrene (0.5 Wt. % in H_2O)	0.1007	5-mL vial
1965	Polystyrene	9.94	1 slide
1978	Zirconium Oxide	0.33 to 2.19	5 g

301. Cement Turbidimetry and Fineness

This SRM is for calibrating the Blaine fineness meter according to the latest issue of Federal Test Method Standard 158, Method 2101 or ASTM Designation C 204; to calibrate the Wagner turbidimeter according to ASTM Designation C 115; and to determine sieve residue according to ASTM Designation C 430. Each set consists of twenty (20) sealed vials, each containing approximately 10 g of cement.

SRM	Type	Properties Certified	Value
114p	Portland Cement	Residue on 45 μm (No. 325) sieve Specific Surface area (Wagner turbidimeter) Specific Surface area (Air permeability)	8.24 % 2086 $\text{cm}^2 \cdot \text{g}^{-1}$ 3774 $\text{cm}^2 \cdot \text{g}^{-1}$

301. Electrophoretic Mobility, μ_E (suspension form)

SRMs 1980 and 1981 are intended for use in the calibration and evaluation of equipment used to measure electrophoretic mobility. Each consists of a goethite suspension saturated with phosphate in a sodium perchlorate electrolyte solution.

SRM	Type	Properties Certified	Unit Size
1980	Goethite (α -FeOOH)	$+\mu_E, -2.53 \mu\text{m} \cdot \text{cm}/\text{V} \cdot \text{s}$ In Prep	40 mL
1981	Goethite (α -FeOOH)		

301. Surface Area of Powders

These materials are for calibrating and checking instruments used to determine the specific surface area of powders by the Brunauer, Emmett and Teller (BET) method. RMs 8570, 8571, and 8572 are issued by NIST in cooperation with ASTM. Their surface areas were determined by both the static (volumetric) and single-point methods.

RM	Type	Surface Area (in m^2/g)		Unit Size (in g)
		Static	Single Point	
8570	Calcined Kaolin	10.9	10.3	25
8571	Alumina	158.7	153.2	25
8572	Silica-Alumina	291.2	277.6	25

302. Surface Finish

Microhardness (block form)

These SRMs are for use in calibrating and checking the performance of microhardness testers. SRMs 1893 through 1907 are 1.25 cm × 1.25 cm (SRM 2798 is 1.35 cm × 1.35 cm) and was made by electroforming the test metal on AISI 1010 steel substrate. SRMs 2830 and 2831 are intended to meet the needs of the structural, electronic and biomedical ceramics communities.

SRM	Type	Load (in Newtons)	Hardness (in kg/mm ²)
1893	Bright Copper (Knoop)	0.245, 0.490, 0.981	125
1894	Bright Copper (Vickers)	0.245, 0.490, 0.981	125
1895	Bright Nickel (Knoop)	0.245, 0.490, 0.981	600
1896	Bright Nickel (Vickers)	0.245, 0.490, 0.981	600
1905	Bright Nickel (Knoop)	2.943	600
1906	Bright Nickel (Knoop)	4.905	600
1907	Bright Nickel (Knoop)	9.81	600
2798	Bright Nickel (Vickers)	4.905	600
2830	Ceramic, Silicon Nitride (Knoop)	In Prep	
2831	Ceramic, Tungsten Carbide (Vickers)	In Prep	

302. Abrasive Wear (block form)

This SRM is for use in the dry sand/rubber wheel abrasion test per ASTM G65, Procedure A.

SRM	Type	Unit Size (in cm)
1857	D-2 Tool Steel	2 blocks: 0.78 × 2.5 × 7.6

302. Corrosion (plate form)

This SRM is for determining the reliability of step test measurements of electrochemical potential and thickness of multilayered nickel deposits. It consists of a 5.0 × 5.0 cm plate of copper-plated steel over which a duplex nickel coating has been deposited.

SRM	Type	Step Test Potential (in mV)	Nickel Coating Thickness Bright Semibright (in μm)	
2350	Nickel Step Test	110 to 150	7	20

302. Surface Roughness (block form)

These SRMs are for calibrating stylus instruments that measure surface roughness. These electroless-nickel coated steel blocks have a sinusoidal roughness profile machined on the top surface.

SRM	Type	Roughness, R _a (in μm)	Wavelength, D (in μm)	Unit Size (in cm)
2071a	Sinusoidal Roughness	0.3	100	block: 2.4 × 3.3
2072	Sinusoidal Roughness	1.0	100	block: 2.4 × 3.3
2073a	Sinusoidal Roughness	3.0	100	block: 2.4 × 3.3
2074	Sinusoidal Roughness	1.0	40	block: 2.4 × 3.3
2075	Sinusoidal Roughness	1.0	800	block: 2.4 × 3.3

303. Nondestructive Evaluation

303. Dye Penetrant Test Blocks

These SRMs are for checking the performance of liquid dye penetrants and dye penetrant crack detection systems and devices for surface defect detection. These test blocks, composed of a laminate cross section of electrodeposited nickel and copper, have four (4) synthetic cracks, approximately 0.2 μm , 0.5 μm , 1 μm , and 2 μm wide.

SRM	Type	Surface	Unit Size (in cm)
1850	Penetrant Test Block	Bright Finish	5D $\times$ 1
1851	NDE Penetrant Test Block	Matte Finish	5D $\times$ 1

303. Artificial Flaw for Eddy Current NDE

This Reference Material (RM) 8458 provides a flaw of known size and geometry that closely resembles an actual fatigue crack. It is intended to produce a response suitable for calibrating eddy current non-destructive evaluation (NDE) systems. The flaw size is 3.0 mm $\times$ 0.1 mm long by 1.0 mm deep in a 7 cm $\times$ 7 cm $\times$ 2 cm block of 7075-T651 aluminum alloy, heat treated to the T6 temper.

303. Magnetic Particle Inspection

SRM 1853 provides a means for obtaining a leakage field of known value. Such a field is useful for verifying the magnetic properties of particles used in Magnetic Particle Inspection (MPI). Each individually calibrated ring was machined from vacuum arc remelted 52100 steel and has a series of holes machined at various depths below the surface.

SRM	Type	Leakage Field Gradient (in Oe/cm)		Unit Size (in cm)
1853	Magnetic Particle Test Ring	min. A	50 to 2000	12.7D $\times$ 2.2
		max. A	100 to 2500	

304. Automatic Data Processing

304. Magnetic Computer Storage Media

These SRMs are for evaluating the performance of magnetic computer storage media and systems in accordance with relevant standards and for maintaining control over their production. Each SRM is individually calibrated and certified relative to NIST Master Standard Reference Tapes.

SRM	Type	Used by Standard(s)	Unit Size
3201	Secondary Standard Magnetic Tape—12.65 mm wide tape, certified for signal amplitude, typical field resolution, overwrite as peak shift at 262 and 394 flux transitions per mm.	ANSI X3.181 X3.197	cartridge
3202	Secondary Standard Magnetic Tape—12.65 mm wide tape certified for signal amplitude, typical field, resolution and overwrite at a data density of 1491 cycles per mm.	ANSI X3.180	cartridge
3203	Secondary Standard Magnetic Tape—6.30 mm wide, certified for signal amplitude, typical field and resolution at 394 flux transitions per mm.	ANSI X3.235	cartridge
3204	Secondary Standard Magnetic Tape—6.30 mm wide, certified for signal amplitude, typical field and resolution at 492 flux transitions per mm.	ANSI X3.325	cartridge
3217	Secondary Standard High Density Magnetic Tape Cartridge—6.30 mm wide tape, certified for signal amplitude outputs at 252 and 394 flux transitions per mm.	ANSI X3.116, X3.127, X3.136	cartridge

305. Fire Research

Surface Flammability (sheet form)

This SRM is for checking the operation of radiant panel test equipment in accordance with the procedures outlined in ASTM E162-78.

SRM	Type	Certification	Unit Size (in cm)
1002d	Hardboard Sheet	Flame Spread Index, I = 153 Heat Evolution Factor, Q = 36.5	Set of 4: 15.2 × 45.7 × 0.63

305. Smoke Density Chamber (sheet form)

These SRMs are certified for maximum specific optical density and are for performing operational checks of smoke density chambers.

SRM	Type	Maximum Specific Optical Density	Unit Size (in cm)
1006c	Non-flaming Exposure Condition (α-cellulose)	Dm (corr.) = 178	6 sheets: 0.05 (thickness)
1007b	Flaming Exposure Condition (plastic)	Dm (corr.) = 421 to 493	3 sheets: 25.4 × 25.4 × 0.076

305. Smoke Toxicity (granular and sheet forms)

SRM 1048 is for checking the operation of the Cup Furnace Smoke Toxicity Method under two (2) observation periods. It consists of eight (8) sheets, 16 cm × 16 cm × 0.76 cm each, of acrylonitrile-butadiene-styrene copolymer. SRM 1049 is for checking the operation of the University of Pittsburgh I Smoke Toxicity Method. It consists of 150 g of Nylon 6/6 granules which is enough to determine the LC₅₀ value four (4) times.

SRM	Type	Combustion Mode	Observation Time	Values	
				LC ₅₀	N-Gas
1048	Smoke Toxicity (ABS sheets)	Flaming	WE *	27	1.4
			WE & PE **	25	1.5
		Nonflaming	WE *	58	1.2
			WE & PE **	53	1.4
1049	Smoke Toxicity (Nylon 6/6)		30-Min. Exposure plus 10-Min. Post-Exposure	4.4	

* WE = within 30 min.

** WE & PE = 30 min + 14 d.

305. Flooring Radiant Panel (sheet form)

This SRM consists of three (3) sheets of kraft paperboard. It is for checking the operation of flooring radiant panel test apparatus used to measure critical radiant flux as per ASTM E648.

SRM	Type	Critical Radiant Flux	Unit Size (in cm)
1012	Flooring Radiant Panel	0.36 W/cm ²	104.1 × 25.4 × 0.305

309. Miscellaneous Performance Engineering Materials

309. Charpy V-Notch Test Blocks

These SRMs are test specimens intended for the certification of Charpy V-Notch testing machines in accordance with ASTM Standard E 23. Each SRM unit consists of five 10 mm × 10 mm × 54 mm steel bars. SRMs 2092 and 2096 are made from 4340 alloy steel; SRM 2098 is made from a high strength maraging steel. The bars are fabricated from vacuum melted, vacuum arc remelted steel, cut to finished lengths, stamped, heat-treated, and machined in SRM lots of ~1200 specimens each. Sample specimens taken at random from each lot, are then tested at the NIST Boulder Laboratory on Charpy V-Notch test reference machines and the data obtained, are statistically evaluated to assure the quality of the lot and to establish its certified energy value.

SRM	Type	Energy Range		
		(in J)	(in kgf · m)	(in ft · lbf)
2092	Low Energy	12.2 to 20.3	1.2 to 2.1	9.0 to 15.0
2096	High Energy	88.1 to 115.2	9.0 to 11.7	65.0 to 85.0
2098	Super High Energy	210.0 to 230.0	21.4 to 23.5	155.0 to 170.0

309. Socketed Ball Bar

This SRM is for measuring the performance of coordinate measuring machines (CMMs) as per ASME Standard B89.1.12. It consists of a set of three (3) precision balls pinned and cemented onto threaded shafts, one (1) table-mount magnetic socket, one (1) ram-mount magnetic socket, and five (5) partially insulated extension tubes—50 mm, 100 mm, 200 mm, 400 mm, and 800 mm long.

SRM	Type	Measuring Lengths (in 50 mm steps)	Unit Size
2083	Socketed Ball Bar	100 to 1650	Set

309. Coordinate Measuring Machine (CMM) Probe Performance

These SRMs are designed to aid in assessing the point-to-point probing performance of a CMM in accordance with the American National Standard "Methods for Performance Evaluation of Coordinate Measuring Machines" ASME B89.1.12 m-1990. SRM 2084 consists of a calibrated 10-mm tungsten carbide sphere mounted on a tungsten carbide stem, and a stainless stand with provisions for mounting the sphere in either a horizontal, vertical or 45 degree inclination. SRMs 2084R and 2085 are separate 10-mm and 25-mm tungsten carbide spheres and stems designed to be used with SRM 2084.

SRM	Type	Unit Size
2084	CMM Probe Performance	Set: 1,10-mm sphere/stem 1, stand
2084R	CMM Probe Performance	10-mm sphere/stem only
2085	CMM Probe Performance	25-mm sphere/stem only

309. Tape Adhesion Testing (sheet form)

This SRM is intended as a uniform source of linerboard for use under ASTM Designation D2860, Procedure A: Adhesion of Pressure Sensitive Tape to Fiberboard at 90 Degree Angle and Constant Stress.

SRM	Type	Unit Size
1810a	Linerboard for Tape Adhesion Testing	50 sheets: 21.6 cm × 28 cm

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SRM/RM Indexes

Subject Index

A

ABSORBANCE

See MOLECULAR ... SPECTROMETRY, 104-106

ACETANILIDE

use in MICROCHEMISTRY, 49

ACIDIMETRIC VALUE (STOICHIOMETRY), 49

of Benzoic Acid

of Boric Acid

of Potassium Hydrogen Phthalate

ACID RAIN

See SIMULATED RAINWATERS, 61

ADHESION (TAPE ADHESION TESTING)

Linerboard for, 131

AGRICULTURAL MATERIALS, 76-77

Apple Leaves

Bovine Muscle

Corn Bran

Corn Kernel

Corn Stalk

Corn Starch

Durum Wheat Flour

Fluoride in Vegetation

Hard Red Spring Wheat Flour

Microcrystalline Cellulose

Peach Leaves

Pine Needles

Soft Winter Wheat Flour

Spinach Leaves

Tomato Leaves

Wheat Gluten

Whole Egg Powder

Whole Milk Powder

AIR PARTICULATES (INORGANIC)

See TRACE ELEMENTS, 62

AIR POLLUTION (ANALYZED GASES)

See MIXTURES AND POLLUTANTS, 63-65

ALCOHOL

Ethanol Solutions, 57

ALCOHOLS (FOSSIL FUELS), 66

Alcohol Mixture

Ethanol

Methanol

Methanol and t-Butanol

ALLOYS (FERROUS)

See FERROUS METALS, 25-38

ALLOYS (NONFERROUS)

See NONFERROUS METALS, 39-47

ALUMINA

as Bauxite (ORES), 79-81

as Burnt REFRACTORIES, 83

Reduction Grade (ORES), 79-81

SECONDARY REFERENCE POINT, 101

for SURFACE AREA OF POWDERS, 124

X-RAY DIFFRACTION, 121

ALUMINUM

Freezing Point of (DEFINING

FIXED POINT, ITS-90), 101

as a METALLO-ORGANIC COMPOUND, 90

Residual Resistivity Ratio, 115

SPECTROMETRY Solution, 50-52

Specular Reflectance (Mirrors), 107

ALUMINUM BASE ALLOYS

See NONFERROUS METALS, 39-47

AMERICIUM (RADIOACTIVITY), 108-113

as Americium-241

as Americium-243

Columbia River Sediment

Human Liver

Human Lung

Peruvian Soil

Rocky Flats Soil Number 1

AMMONIUM DIHYDROGEN PHOSPHATE

constituent in FERTILIZERS, 78

ANALYZED GASES

See MIXTURES AND POLLUTANTS, 63-65

See PERMEATION DEVICES, 65

ANGIOTENSIN I

See CLINICAL LABORATORY MATERIALS, 56

ANISIC ACID

use in MICROCHEMISTRY, 49

ANION CHROMATOGRAPHY, 53

Bromide Solution

Chloride Solution

Fluoride Solution

Nitrate Solution

Phosphate Solution

Sulfate Solution

ANTICONSULSANT DRUG LEVEL ASSAY

See CLINICAL LABORATORY MATERIALS, 56

ANTI-EPILEPSY DRUG LEVEL ASSAY

See CLINICAL LABORATORY MATERIALS, 56

ANTIMONY

as Antimony-125 Mixed Nuclide

(RADIOACTIVITY), 108-113

SPECTROMETRY Solution, 50-51

ARGILLACEOUS LIMESTONE

See ROCKS AND MINERALS, 83

ARSENIC

in FREEZE-DRIED URINE, 57

in MATERIALS ON FILTER MEDIA, 59

SPECTROMETRY Solution, 50–52

ARSENIC TRIOXIDE (STOICHIOMETRY)

Reductometric value of, 49

ASBESTOS, 60

Common Commercial

Uncommon Commercial

Mixture on Filter

ASPARTATE AMINOTRANSFERASE

CLINICAL LABORATORY MATERIALS, 56

ATOMIC ABSORPTION SPECTROMETRY

See SPECTROMETRY, MULTI-ELEMENT, 51–52

See SPECTROMETRY, SINGLE ELEMENT, 50–51

AUSTENITE IN FERRITE

See X-RAY DIFFRACTION OF FERROUS MATERIALS, 121

AUTO CATALYSTS

in Platinum Group Metals, 62

B**BARIUM**

as Barium-133 (RADIOACTIVITY), 108–113

as Cesium-137 Burn-up Standard (RADIOACTIVITY), 108–113

as a METALLO-ORGANIC COMPOUND, 90
SPECTROMETRY Solution, 50–52

BASALT ROCK

See ROCKS AND MINERALS, 83

BASIMETRIC VALUE (STOICHIOMETRY)

of Tris(hydroxymethyl)aminomethane, 49

BAUXITE (ORES), 79–81

from Arkansas

from Australia

from the Dominican Republic

from Jamaica

from Surinam

BEARING METAL (Pb-Sb-Sn)

See LEAD BASE ALLOYS, 43

BENZOIC ACID

Acidimetric Value of (STOICHIOMETRY), 49

Calorimetric Value of (THERMODYNAMIC PROPERTIES), 99–103

BERYLLIUM

in ALUMINUM BASE ALLOYS, 39

in COPPER BASE ALLOYS, 40–41

in MATERIALS ON FILTER MEDIA, 59

SPECTROMETRY Solution, 50–51

BET

abbr. for Brunauer, Emmett, and Teller (method)

BET SURFACE AREA

See SURFACE AREA OF POWDERS, 126

BEVERAGE

See FOODS AND BEVERAGES, 75

BILIRUBIN

See CLINICAL LABORATORY MATERIALS, 56

BIOLOGICAL

See FOOD AND AGRICULTURE, 75–78

See HEALTH AND INDUSTRIAL HYGIENE, 56–60

BIOLOGICAL BUFFER SYSTEMS (ION ACTIVITY), 95

HEPES Free Acid

MOPSO Free Acid

NaHEPESate

NaMOPSOate

BIOMASS MATERIALS, 78

Eastern Cottonwood

Pinus Radiata

Sugar Cane Bagasse

Wheat Straw

BIPHENYL

for DIFFERENTIAL SCANNING CALORIMETRY, 100

BISMUTH

SPECTROMETRY Solution, 50

BLOOD GAS

See CLINICAL LABORATORY MATERIALS, 56

See MIXTURES AND POLLUTANTS, 63–65

BONE ASH

See CLINICAL REFERENCE MATERIALS, 56

BONE MEAL

SEE CLINICAL REFERENCE MATERIALS, 56

BORATE ORE

See ORES, 79–81

BORON

SPECTROMETRY Solution, 50

BORIC ACID

Acidimetric/Assay Values of (STOICHIOMETRY), 49

Enriched in Boron-10 (STABLE ISOTOPIC MATERIALS), 53

BOTANICAL

See AGRICULTURAL MATERIALS, 77

BOVINE

Liver (FOOD AND AGRICULTURE), 75–78

Muscle Powder (USA/CANADA COLLABORATIVE MATERIALS), 76

Serum Albumin (CLINICAL REFERENCE MATERIALS), 56

BRASS

See NONFERROUS METALS, 39–47

BREWERS YEAST

See FOODS AND BEVERAGES, 75

BROMIDE

ANION CHROMATOGRAPHY Solution, 53

Sodium Bromide (STABLE ISOTOPIC MATERIALS), 53

BROMINE

in FOOD AND AGRICULTURE, 75–78

BROMO COMPOUNDS

o-Bromobenzoic Acid (MICROCHEMISTRY), 49

BRONZE

See COPPER BASE ALLOYS, 40–41

BUFFERS

See ION ACTIVITY, 95–96

BURNT REFRACTORIES (ALUMINUM OXIDE)

See REFRACTORIES, 83

BUTYL RUBBER

See RUBBERS AND RUBBER COMPOUNDING MATERIALS, 98

C

CADMIUM

- Cadmium Cyclohexanebutyrate
(METALLO-ORGANIC COMPOUND), 90
- in MATERIALS ON FILTER MEDIA, 59
- SPECTROMETRY Solution, 50–52
- VAPOR PRESSURE OF METALS, 102

CALCIUM

- Calcium Carbonate (CLINICAL LABORATORY MATERIALS), 56
- Calcium Molybdate (STEELMAKING ALLOYS), 36
- SPECTROMETRY Solution, 50–52

CALORIMETRY (THERMODYNAMIC PROPERTIES)

- COMBUSTION CALORIMETRY, 99
- DIFFERENTIAL SCANNING CALORIMETRY, 100
- DIFFERENTIAL THERMAL ANALYSIS, 100
- ENTHALPY AND HEAT CAPACITY, 99
- SOLUTION CALORIMETRY, 99

CARBIDES (CERAMICS AND GLASSES)

- Silicon CARBIDE, 85
- Tungsten CARBIDE, 85
- See CEMENTED CARBIDES, 85

CARBON

- Carbon Modified Silicon (INORGANICS), 62
- Carbon-14 Dating
(RADIOACTIVITY), 108–113
- in PLAIN CARBON STEELS
(FERROUS METALS), 25–38
- in RUBBERS AND RUBBER COMPOUNDING MATERIALS, 98

CARBON DIOXIDE (MIXTURES AND POLLUTANTS), 63–65

- Blood Gas
- Carbon Dioxide and Nitrous Oxide in Air
- Carbon Dioxide in Nitrogen
- Carbon Monoxide, Propane, and Carbon Dioxide
in Nitrogen

CARBON MONOXIDE (MIXTURES AND POLLUTANTS), 63–65

- Carbon Monoxide in Air
- Carbon Monoxide in Nitrogen
- Carbon Monoxide and Propane in Nitrogen
- Carbon Monoxide, Propane, and Carbon Dioxide
in Nitrogen

β-CAROTENE (FAT SOLUBLE VITAMINS)

- in Human Serum (CLINICAL LABORATORY MATERIALS), 56

CAST IRON

- See FERROUS METALS, 25–38

CAST STEEL

- See FERROUS METALS, 25–38

CATALYST MATERIALS (ENGINE WEAR MATERIALS)

- Catalyst Package (FOR LUBRICANT OXIDATION), 91
- High Sulfur Gas Oil Feed (CATALYST CHARACTERIZATION MATERIALS), 91

CELLULOSE

- Microcrystalline (USA/CANADA COLLABORATIVE MATERIALS), 76

CEMENTS

- CEMENT TURBIDIMETRY AND FINENESS
(SIZING), 125

- PORTLAND CEMENT CLINKERS, 89

- PORTLAND CEMENTS, 88

CERAMIC MATERIALS (CERAMICS AND GLASSES)

- CARBIDES, 85
- CEMENTED CARBIDES, 85
- GLASSES, 86
- See REFRACTORIES, 83
- See ROCKS AND MINERALS, 83
- See SPECULAR SPECTRAL REFLECTANCE, 107

CERIUM

- SPECTROMETRY Solution, 50

CESIUM (RADIOACTIVITY), 108–113

- as Cesium-137 Burn-up Standard
- as Cesium-137-Barium-137
- SPECTROMETRY Solution, 50

CHARPY

- V-NOTCH TEST BLOCKS, 131

CHEMICAL

- See HIGH PURITY MATERIALS, 48–55

CHLORIDE

- by ANION ION CHROMATOGRAPHY, 53
- CLINICAL LABORATORY MATERIALS, 56
- in SERUM MATERIALS, 57
- in SIMULATED RAINWATERS, 61

CHLORINE

- as Chlorine-36 (RADIOACTIVITY), 108–113
- in LUBRICATING BASE OILS, 90
- STABLE ISOTOPES of, 53
- as a Trace Element in FOSSIL FUELS, 68

CHLORO COMPOUNDS (ORGANIC

CONSTITUENTS), 69–74

- in Biphenyls
- in Cod Liver Oil
- in Halocarbons
- m-Chlorobenzoic Acid (MICROCHEMISTRY), 49
- in Pesticides
- in Phenols
- in Pollutants

CHOLESTEROL

- in Coconut Oil (FOODS AND BEVERAGES), 75
- in Human Serum (CLINICAL LABORATORY MATERIALS), 56
- in Whole Egg Powder (FOODS AND BEVERAGES), 75

CHROMIUM

- as Chromium-51 (RADIOPHARMACEUTICALS), 110
- as Chromium Nitrate (STABLE ISOTOPIC MATERIALS), 53
- in CLAYS, 82
- Cr/CrO Thin Film Depth Profile, 116
- Tris (1-phenyl-1,3-butanediono)chromium (III)
(METALLO-ORGANIC COMPOUNDS), 90
- SPECTROMETRY Solution, 50–52
- in Steels (FERROUS METALS), 25–38

CHROMIUM COMPOUNDS

- in ROCKS AND MINERALS, 83

CHROMIUM SPECIATION

See HIGH-PURITY MATERIALS, 48

CHRYSOTILE

in ASBESTOS (HEALTH AND INDUSTRIAL HYGIENE), 60

CLAYS, 82

Brick

Flint

Plastic

CLINICAL LABORATORY MATERIALS, 56

Angiotensin I (Human)

Anticonvulsant Drug Level Assay

Antiepilepsy Drug Level Assay

Bilirubin

Blood Gases

Bovine Serum—Inorganic Constituents

Calcium Carbonate

Cholesterol

Cortisol (Hydrocortisone)

Creatinine

Electrolytes in Serum for ISE

D-Glucose (Dextrose)

Iron Metal

Lead Nitrate

Lithium Carbonate

Magnesium Gluconate Dihydrate

D-Mannitol

4-Nitrophenol

Potassium Chloride

Sodium Chloride

Sodium Pyruvate

Tripalmitin

Urea

Uric Acid

Vitamins (Fat Soluble) in Human Serum

VMA (4-hydroxy-3-methoxymandelic acid)

COAL

for COMBUSTION CALORIMETRY, 99

Sulfur in (SULFUR IN FOSSIL FUELS), 67

TRACE ELEMENTS in, 68

Trace Mercury in (METAL CONSTITUENTS), 566

COAL FLY ASH

TRACE ELEMENTS in, 68

COATING THICKNESS

Nonmagnetic—COPPER AND

CHROMIUM ON STEEL, 117

Tin-Lead Alloy (SOLDER THICKNESS), 117

COATING WEIGHT

GOLD ON IRON-NICKEL-COBALT ALLOY, 117

COBALT

as Cobalt-60 (RADIOACTIVITY), 108–113

SPECTROMETRY Solution, 50–52

COCAINE METABOLITE

See FREEZE-DRIED URINE, 58

COCONUT OIL

Cholesterol in (FOODS AND BEVERAGES), 75

COD LIVER OIL

Organics in (ORGANIC CONSTITUENTS), 69–74

COLUMBIA RIVER SEDIMENT

See NATURAL MATRIX MATERIALS (RADIOACTIVITY), 113

COMPUTER (AUTOMATIC DATA PROCESSING)

MAGNETIC COMPUTER STORAGE MEDIA, 129

CONDUCTIVITY (EDDY CURRENT)

of Aluminum, 115

CONDUCTIVITY, ELECTRICAL (ELECTRICAL PROPERTIES), 114–115

of Electrolytic Iron

of Lead-Silica (ELECTRICAL PROPERTIES OF GLASS), 119

of Stainless Steel

of Sintered Tungsten

CONDUCTIVITY, ELECTROLYTIC (ION ACTIVITY), 96

Hydrochloric Acid in Water

Potassium Chloride in Water

Potassium Chloride in Water-Propanol Mixture

Sodium Chloride in Water

CONDUCTIVITY, THERMAL (THERMODYNAMIC PROPERTIES), 103

of Electrolytic Iron

of Graphite

of Sintered Tungsten

of Stainless Steel

COORDINATE MEASURING MACHINE PROBE PERFORMANCE, 131**COPPER**

Bis(1-phenyl-1,3-butanediono)copper (II)

(METALLO-ORGANIC COMPOUNDS), 90

Brass (COPPER BASE ALLOYS), 40–41

Bronze (COPPER BASE ALLOYS), 40–41

Cupro-Nickel (COPPER BASE ALLOYS), 40–41

ENTHALPY AND HEAT CAPACITY of, 99

in FERROUS METALS, 25–38

Freezing Point of (SECONDARY REFERENCE POINTS), 101

Gilding Metal (COPPER BASE ALLOYS), 40–41

High-Purity METAL (MICROANALYSIS), 47

Nickel Silver (COPPER BASE ALLOYS), 40–41

in NONFERROUS METALS, 39–47

in ORES, 79–81

as Phosphorized Copper (COPPER “BENCHMARK”), 42

SPECTROMETRY Solution, 50–52

STABLE ISOTOPES of, 53

as Unalloyed Copper (COPPER “BENCHMARK”), 42

COPPER BASE ALLOYS

See NONFERROUS METALS, 39–47

CORN

Bran (USA/CANADA COLLABORATIVE MATERIALS), 76

Kernel (AGRICULTURAL MATERIALS), 77

Stalk (AGRICULTURAL MATERIALS), 77

Starch (USA/CANADA COLLABORATIVE MATERIALS), 76

CORROSION

- Nickel Step Test, 127
- Tool Steel (ABRASIVE WEAR), 127

CORTISOL (HYDROCORTISONE)

- See CLINICAL LABORATORY MATERIALS, 56

COTININE

- in FREEZE-DRIED URINE, 58

CREATININE

- See CLINICAL LABORATORY MATERIALS, 56

CRUDE OIL

- Vanadium in (METAL CONSTITUENTS), 66

CUP FURNACE (FIRE RESEARCH)

- See SMOKE TOXICITY 130

CURIUM (RADIOACTIVITY), 108–113

- as Curium-243
- as Curium-244

CYSTINE

- See MICROCHEMISTRY, 49

D

DENSITY

- of Lead Silica Glass, 122
- Neutron—Monitor Wire (RADIATION DOSIMETRY), 108
- of Smoke (SMOKE DENSITY CHAMBER), 130
- of Soda-Lime Glass, 122
- of Toluene, 122

DEPTH PROFILING, 116

- Chromium/Chromium Oxide Thin Film
- Nickel/Chromium Thin Film

Dextrose (D-Glucose)

- See CLINICAL LABORATORY MATERIALS, 56

DURUM WHEAT FLOUR

- See USA/CANADA COLLABORATIVE MATERIALS, 76

DIFFERENTIAL SCANNING CALORIMETRY, 100

- Biphenyl
- Mercury
- Thermal Analysis Purity Set
- Tin
- Zinc

DIFFERENTIAL THERMAL ANALYSIS, 100

DIFFRACTION (X-RAY), 121

- of FERROUS MATERIALS, 121

DIOXIN (IN ISO OCTANE)

- See ORGANIC CONSTITUENTS, 69–74

DISODIUM HYDROGEN PHOSPHATE

- for pD CALIBRATION, 95
- for pH CALIBRATION, 95

DNA

- abbr. for Deoxyribonucleic Acid

DNA PROFILING

- (HEALTH AND INDUSTRIAL HYGIENE), 59
- DNA Profiling
- PCR-Based DNA Profiling
- DNA Mitochondrial Sequencing

DOLOMITIC LIMESTONE

- See ROCKS AND MINERALS, 83

DOSIMETRY (RADIOACTIVITY)

- Neutron density (RADIATION DOSIMETRY), 108

DRUG LEVEL ASSAY

- See CLINICAL LABORATORY MATERIALS, 56

DRUGS OF ABUSE

- in FREEZE-DRIED URINE, 58
- in HAIR, 58

DSC

- abbr. for Differential Scanning Calorimetry

DTA

- abbr. for Differential Thermal Analysis

DUST

- Urban (TRACE ELEMENTS), 62
- Urban (ORGANIC CONSTITUENTS), 69–74

DYE PENETRANT TEST (CRACK) BLOCK (NONDESTRUCTIVE EVALUATION), 128

- Bright Finish
- NDE—Matte Finish

DYSPROSIUM

- SPECTROMETRY Solution, 50

E

EDDY CURRENT

- Aluminum, 115
- ARTIFICIAL FLAW FOR NDE, 128
- DYE PENETRANT TEST BLOCKS, 128
- Silicon, 114

ELECTRICAL RESISTIVITY AND CONDUCTIVITY (ELECTRICAL PROPERTIES), 114–115

- of Electrolytic Iron
- of Silicon
- of Stainless Steel
- of Sintered Tungsten

ELECTRICAL RESISTIVITY

- See RESIDUAL RESISTIVITY RATIO, 115

ELECTROLYTIC CONDUCTIVITY (ION ACTIVITY)

- Potassium Chloride Solutions for, 96

ELECTRONIC AND MAGNETIC ALLOY, 44

- Nickel-Iron
- Nickel-Molybdenum

ELECTROPHORETIC MOBILITY (SIZING), 126

ELLIPSOMETRY THIN FILM

- Silicon Dioxide on Silicon, 118

ENGINEERING MATERIALS

- See GUIDE TO SRM/RM TECHNICAL CATEGORIES, 19–21

ENTHALPY (THERMODYNAMIC PROPERTIES), 99

- of Copper
- of Molybdenum
- of Synthetic Sapphire
- of Polystyrene

ENVIRONMENTAL MATRICES

- See METAL CONSTITUENTS (INORGANICS), 61
- See NATURAL MATRIX MATERIALS (RADIOACTIVITY), 113
- See ORGANIC CONSTITUENTS (ORGANICS), 69–74
- See SIMULATED RAINWATERS, 61
- See TRACE ELEMENTS (FOSSIL FUELS), 68

ENZYME

- See CLINICAL LABORATORY MATERIALS, 56

ERBIUM

- SPECTROMETRY Solution, 50

ESTUARINE SEDIMENT

- See TRACE ELEMENTS (FOSSIL FUELS), 68

ETHANOL

- Ethanol (ALCOHOLS AND ETHERS IN REFERENCE FUELS), 66
- Ethanol-Water (ETHANOL SOLUTIONS), 57

ETHERS (ALCOHOLS AND ETHERS IN REFERENCE FUELS), 66

- t-Amyl Methyl Ether,
- Ethyl t-Butyl Ether,
- Methyl t-Butyl Ether,

EUCALYPTUS HARDWOOD

- BLEACHED KRAFT PULPS, 122

EUROPIUM

- as Europium-152 (RADIOACTIVITY), 108–113
- as Europium-154/Europium-155 Mixed Nuclide (RADIOACTIVITY), 108–113
- SPECTROMETRY solution, 50

F

FELDSPAR (ROCKS AND MINERALS), 83

- in Potash
- in Soda

FERRITE

- Austenite in (X-RAY DIFFRACTION OF FERROUS MATERIALS), 121

FERROUS ALLOYS

- See FERROUS METALS, 25–38

FERTILIZERS (FOOD AND AGRICULTURE), 78

- Ammonium Dihydrogen Phosphate
- Phosphate Rock (Florida & Western)
- Potassium Dihydrogen Phosphate
- Potassium Nitrate

FIBROUS GLASS BLANKET

- See THERMAL RESISTANCE OF GLASS AND SILICA, 103

FIBROUS GLASS BOARD

- See THERMAL RESISTANCE OF GLASS AND SILICA, 103

FILTER MEDIA (MATERIALS ON FILTER MEDIA), 59

- Beryllium and Arsenic on
- Metals on
- Quartz on

FILTERS

- See MOLECULAR ... SPECTROMETRY, 104–106

FINENESS (SIZING)

- of Portland Cement (CEMENT TURBIDIMETRY AND FINENESS), 125

FIRE RESEARCH, 130

- FLOORING RADIANT PANEL
- SMOKE DENSITY
- SMOKE TOXICITY
- SURFACE FLAMMABILITY

FISSION TRACK GLASS (RADIOACTIVITY), 108

- Irradiated
- Unirradiated

FLAMMABILITY

- SURFACE FLAMMABILITY (FIRE RESEARCH), 130

FLEXIBLE DISK CARTRIDGE

- MAGNETIC COMPUTER STORAGE MEDIA, 129

FLOORING RADIANT PANEL

- See FIRE RESEARCH, 130

FLOUR

- Durum Wheat (USA/CANADA COLLABORATIVE MATERIALS), 76
- Hard Red Spring Wheat (USA/CANADA COLLABORATIVE MATERIALS), 76
- Rice (FOODS AND BEVERAGES), 75
- Soft Winter Wheat (USA/CANADA COLLABORATIVE MATERIALS), 76
- Wheat (FOODS AND BEVERAGES), 75

FLUORESCENCE

- Quinine Sulfate Dihydrate (MOLECULAR ... SPECTROMETRY), 104–106

FLUORIDE

- ANION CHROMATOGRAPHY solution, 53
- in FREEZE-DRIED URINE, 55
- in Vegetation (AGRICULTURAL MATERIALS), 77

FLUORO COMPOUNDS

- p-Fluorobenzoic Acid (MICROCHEMISTRY), 49

FLUORSPAR (GEOLOGICAL MATERIALS AND ORES), 79–84

- Customs Grade
- High Grade

FLY ASH COAL

- Coal Fly Ash (TRACE ELEMENTS)/ (FOSSIL FUELS), 68

FOODS AND BEVERAGES (FOOD AND AGRICULTURE), 75–78

- Bovine Liver
- Brewers Yeast
- Coconut Oil
- Non-fat Milk Powder
- Oyster Tissue
- Rice Flour
- Stabilized Wine
- Total Diet
- Wheat Flour
- Whole Egg Powder

FOSSIL FUELS

- Alcohols (ALCOHOLS AND ETHERS IN REFERENCE FUELS), 66
- Coal Heat of Combustion (COMBUSTION CALORIMETRY), 99
- Ethanol (ALCOHOLS AND ETHERS IN REFERENCE FUELS), 66
- Isooctane (REFERENCE LIQUIDS FOR EVALUATING FUELS), 67
- n-Heptane (REFERENCE LIQUIDS FOR EVALUATING FUELS), 67
- METAL CONSTITUENTS in Reference Fuel, 66
- METAL CONSTITUENTS in Residual Fuel Oil, 66
- Methanol (ALCOHOLS AND ETHERS IN REFERENCE FUELS), 66
- Methanol and t-Butanol (ALCOHOLS AND ETHERS IN REFERENCE FUELS), 66
- Sulfur in Coal (SULFUR IN FOSSIL FUELS), 67

Sulfur in Distillate Fuel oil (SULFUR IN FOSSIL FUELS), 67
 Sulfur in Kerosine (SULFUR IN FOSSIL FUELS), 67
 Sulfur in Residual Fuel Oil (SULFUR IN FOSSIL FUELS), 67
 Synthetic Refuse Derived Oil (COMBUSTION CALORIMETRY), 99
 TRACE ELEMENTS in Coal, 68
 TRACE ELEMENTS in Coal Fly Ash, 68
 TRACE ELEMENTS in Fuel Oil, 68
 Vanadium in Crude Oil (METAL CONSTITUENTS IN FOSSIL FUELS), 66

FREEZING POINT (THERMODYNAMIC PROPERTIES)
 of Aluminum (DEFINING FIXED POINT, ITS-90), 101
 of Copper (SECONDARY REFERENCE POINTS), 101
 of Lead (SECONDARY REFERENCE POINTS), 101
 of Silver (DEFINING FIXED POINT, ITS-90), 101
 of Tin (DEFINING FIXED POINT, ITS-90), 101
 of Zinc (DEFINING FIXED POINT, ITS-90), 101

FSV
 abbr. for Fat Soluble Vitamins

FUELS
 See FOSSIL FUELS, 66–68

FUMED SILICA BOARD
 See THERMAL RESISTANCE OF GLASS AND SILICA, 103

G

GADOLINIUM
 SPECTROMETRY Solution, 50

GALLIUM
 in Buffalo River Sediment (SOILS AND SEDIMENTS), 84
 in Coal (TRACE ELEMENTS), 68
 in Coal Fly Ash (TRACE ELEMENTS), 68
 as Gallium-67 (RADIOPHARMACEUTICALS), 110
 in Glass (TRACE ELEMENTS), 87
 MELTING POINT AND/OR TRIPLE POINT (THERMODYNAMIC PROPERTIES), 101
 Metal (STABLE ISOTOPIC MATERIALS), 53
 SPECTROMETRY Solution, 50

GAS CHROMATOGRAPHY (ORGANIC CONSTITUENTS), 69
 GC/MS System Performance
 LC Selectivity

GASES (ANALYZED GASES)
 See MIXTURES AND POLLUTANTS, 63–65
 See PERMEATION DEVICES, 65

GASES IN METALS (NONFERROUS METALS), 46
 in Unalloyed Titanium

GASOLINE
 See FOSSIL FUELS, 66–68

GEOLOGICAL
 See GEOLOGICAL MATERIALS AND ORES, 79–84

GERMANIUM
 SPECTROMETRY Solution, 50

GLASS BEADS
 See SIZING, 125–126

GLASSES

Borosilicate (CHEMICAL RESISTANCE) and (VISCOSITY OF GLASS), 119
 CHEMICAL COMPOSITION, 86–87
 DENSITY AND REFRACTIVE INDEX of, 122
 ELECTRICAL PROPERTIES OF Lead-Silica, 119
 Fused Ore Glass, 86
 GLASS LIQUIDUS TEMPERATURE, 120
 High-Boron Borosilicate, 86
 Lead-Barium, 86
 Lead-Silica (ELECTRICAL PROPERTIES OF GLASS) (VISCOSITY OF GLASS), 119
 Low-Boron Soda-Lime Powder, 86
 LABORATORY THERMOMETER (MERCURY IN GLASS), 102
 Multi Component, 86
 Opal Powder, 86
 RELATIVE STRESS OPTICAL COEFFICIENT of, 120
 Sand (ROCKS AND MINERALS), 83
 Soda-Lime Container, 86
 Soda-Lime Flat, 86
 Soda-Lime Float, 86
 Soda-Lime Sheet, 86
 Soda-Lime-Silica (VISCOSITY OF GLASS), 119
 Soft Borosilicate, 86
 SYNTHETIC GLASS (MICROANALYSIS), 47
 SYNTHETIC GLASS (TRACE ELEMENTS), 87
 THERMAL EXPANSION OF GLASS AND SILICA, 103
 THERMAL RESISTANCE OF GLASS AND SILICA, 103
 VISCOSITY FIXPOINTS of, 120

GLASS SAND
 See ROCKS AND MINERALS, 83

GLASS SPHERES
 PARTICLE SIZE (SIZING), 125–126

D-GLUCOSE
 aka. Dextrose (CLINICAL LABORATORY MATERIALS), 56
 Reductometric Value of (STOICHIOMETRY), 49

GOETHITE
 aka, α -FeOOH (ELECTROPHORETIC MOBILITY), 126

GOLD
 COATING ON Fe-Ni-Co ALLOY (METROLOGY), 117
 First Surface, Gold on Glass (SPECULAR SPECTRAL REFLECTANCE), 107
 METALS (HIGH PURITY METALS), 48–55
 METALS (MICROANALYSIS), 47
 Ore, Refractories, 83
 SPECTROMETRY Solution, 50–52
 VAPOR PRESSURE OF METALS, 102
 Royal Canadian Mint Reference Materials (HIGH PURITY MATERIALS), 54–55

GRAPHITE
 THERMAL CONDUCTIVITY OF GRAPHITE AND METALS, 103

GRAVITY SEDIMENTATION
 Zirconium Oxide (PARTICLE SIZE), 125

H

HAFNIUM

SPECTROMETRY Solution, 50
in Zircaloy (ZIRCONIUM BASE ALLOYS), 46
in Zirconium (ZIRCONIUM BASE ALLOYS), 46

HARDNESS (SURFACE FINISH)

of Bright Copper (MICROHARDNESS), 127
of Bright Nickel (MICROHARDNESS), 127

HASTELLOY

HIGH TEMPERATURE ALLOYS, 35

HEAT (THERMODYNAMIC PROPERTIES), 99-103

COMBUSTION CALORIMETRY
DEFINING FIXED POINT, ITS-90
DIFFERENTIAL SCANNING CALORIMETRY
DIFFERENTIAL THERMAL ANALYSIS
ENTHALPY AND HEAT CAPACITY
LABORATORY THERMOMETER
MELTING POINT AND TRIPLE POINT
SECONDARY REFERENCE POINTS
SOLUTION CALORIMETRY
SUPERCONDUCTIVE THERMOMETRIC
FIXED POINT DEVICE
THERMAL CONDUCTIVITY OF GRAPHITE
AND METALS
THERMAL EXPANSION OF GLASS AND SILICA
THERMAL RESISTANCE OF GLASS AND SILICA,
THERMOCOUPLE MATERIAL
VAPOR PRESSURE OF METALS

HEPES (ION ACTIVITY)

abbr. for N-2-Hydroxyethyl-piperazine-N'-2-ethanesulfonic
Acid
HEPES Free Acid (BIOLOGICAL BUFFER
SYSTEMS), 95
NaHEPESate (BIOLOGICAL BUFFER
SYSTEMS), 95

n-HEPTANE (FOSSIL FUELS)

REFERENCE LIQUIDS FOR RATING FUELS, 67

HIGH ALLOY STEELS (FERROUS METALS), 28

Cr-Ni (Cu Precipitation Hardening)
Cr-Ni (Mo Precipitation Hardening)
High Nickel
High Temperature Alloy (A286) Ni-Cr
High Temperature Alloy L605
High Temperature Alloy Fe-Ni-Co
Valve Steel

HIGH-PURITY METALS, 48

High-Purity Gold
High-Purity Platinum
High-Purity Zinc
Refined Copper
Selenium Intermediate Purity
Zinc Intermediate Purity
Zinc Metal

HIGH TEMPERATURE ALLOYS (FERROUS METALS), 35

A 286
Fe-Ni-Co
Hastelloy C
High Alloy Steel ACI (17/4 PH)

High Alloy Steel (ACI-C-4M-Cu)

Incoloy 800

Incoloy 825

Inconel 600

Inconel 625

HOLMIUM

Holmium Oxide Solution Wavelength (MOLECULAR ...
SPECTROMETRY), 104-106
SPECTROMETRY Solution, 50

HUMAN

See CLINICAL LABORATORY MATERIALS, 56
LIVER (NATURAL MATRIX MATERIALS)
(RADIOACTIVITY), 113
LUNG (NATURAL MATRIX MATERIALS)
(RADIOACTIVITY), 113
Serum (SERUM MATERIALS), 57

HUMAN SERUM (HEALTH AND INDUSTRIAL HYGIENE)

Cholesterol in Human Serum (CLINICAL
LABORATORY MATERIALS), 57
Electrolytes in (CLINICAL LABORATORY
MATERIALS), 56
Fat Soluble Vitamins in (CLINICAL LABORATORY
MATERIALS), 56
SERUM MATERIALS, 57

HUMAN SERUM (ORGANICS)

Polychlorinated Biphenyls in (ORGANIC
CONSTITUENTS), 69-74

HYDROGEN

as Hydrogen-3 (RADIOACTIVITY), 108-113
Unalloyed Titanium for (GASES IN METALS), 46

4-HYDROXY-3-METHOXY-DL-MANDELIC ACID (VMA)

See CLINICAL LABORATORY MATERIALS, 56

I

ICTAC

abbr. for International Confederation of Thermal Analysis
and Calorimetry

IMAGE QUALITY INDICATOR (OPTICAL PROPERTIES) PHOTOGRAPHY, 107

INDIUM

as Indium-111 (RADIOPHARMACEUTICALS), 110
MELTING POINT AND TRIPLE POINT, 101
SPECTROMETRY Solution, 50

INDUSTRIAL HYGIENE

See HEALTH AND INDUSTRIAL HYGIENE, 56-60

INFRARED, NEAR

DIRECTIONAL HEMISPHERICAL
REFLECTANCE, 107
INFRARED REFLECTANCE, 107

INSTRUMENT PERFORMANCE

See GUIDE TO SRM/RM TECHNICAL
CATEGORIES, 19-21

IODINE (RADIOACTIVITY), 108-113

as Iodine-125 (RADIOPHARMACEUTICALS)
as Iodine-129
as Iodine-131 (RADIOPHARMACEUTICALS)

ION ACTIVITY, 95–96
 BIOLOGICAL BUFFER SYSTEMS
 ELECTROLYTIC CONDUCTIVITY
 ION-SELECTIVE ELECTRODE CALIBRATION
 pD CALIBRATION
 pH CALIBRATION

IRON
 Electrolytic Iron (THERMAL CONDUCTIVITY OF GRAPHITE AND METALS), 103
 Electrolytic Iron (ELECTRICAL RESISTIVITY AND CONDUCTIVITY OF METALS), 114
 See FERROUS METALS, 25–38
 as Iron-55 (RADIOACTIVITY), 108–113
 Iron Metal (CLINICAL LABORATORY MATERIALS), 56
 SPECTROMETRY Solution, 50–52
 Tris(1-phenyl-1,3-butanediono)iron (III) (METALLO-ORGANIC COMPOUNDS), 90

ISOBUTYLENE-ISOPRENE
 See RUBBERS AND RUBBER COMPOUNDING MATERIALS, 98

ISOTOPE(S)
 See LIGHT STABLE ISOTOPIC MATERIALS (HIGH-PURITY MATERIALS), 55
 See RADIOACTIVITY, 108–113
 See STABLE ISOTOPIC MATERIALS (HIGH-PURITY MATERIALS), 53

K

KAOLIN
 SURFACE AREA OF POWDERS (SIZING), 126

KEROSINE
 Sulfur in (SULFUR IN FOSSIL FUELS), 67

KNOOP (SURFACE FINISH)
 Bright Copper (MICROHARDNESS), 127
 Bright Nickel (MICROHARDNESS), 127

L

LANTHANUM
 SPECTROMETRY Solution, 50

LAKE SEDIMENT (RADIOACTIVITY)
 Freshwater Lake Sediment (NATURAL MATRIX MATERIALS), 113

LEAD
 Lead Cyclohexanebutyrate (METALLO-ORGANIC COMPOUNDS), 90
 Lead Nitrate (CLINICAL LABORATORY MATERIALS), 56
 Metal, Equal Atom (STABLE ISOTOPIC MATERIALS), 53
 Metal, Natural (STABLE ISOTOPIC MATERIALS), 53
 Metal, Radiogenic (STABLE ISOTOPIC MATERIALS), 53
 Metals on filter Media (MATERIALS ON FILTER MEDIA), 59
 See NONFERROUS METALS, 39–47
 Powdered Lead Base Paint (LEAD IN PAINT), 60
 in Paint (HEALTH AND INDUSTRIAL HYGIENE), 60
 in Reference Fuel (METAL CONSTITUENTS IN FOSSIL FUELS), 66

SECONDARY REFERENCE POINTS, 101
 SPECTROMETRY Solution, 50–52

LEAVES (AGRICULTURAL MATERIALS), 77
 Apple
 Peach
 Pine Needles
 Spinach
 Tomato

LIMESTONE (ROCKS AND MINERALS), 83
 Argillaceous
 Dolomitic

LINERBOARD
 for TAPE ADHESION TESTING, 131

LINEWIDTH (METROLOGY)
 OPTICAL MICROSCOPE LINEWIDTH MEASUREMENT, 116

LIQUIDUS TEMPERATURE (THERMODYNAMIC PROPERTIES), 120

LITHIUM
 Carbonate (LIGHT STABLE ISOTOPIC MATERIALS), 55
 Carbonate (CLINICAL LABORATORY MATERIALS), 56
 Lithium Cyclohexanebutyrate (METALLO-ORGANIC COMPOUNDS), 90
 Ore, Lepidolite (ORES), 79–81
 Ore, Petalite (ORES), 79–81
 Ore, Spodumene (ORES), 79–81
 SPECTROMETRY Solution, 50

LIVER
 Bovine (FOODS AND BEVERAGES), 75
 Human (NATURAL MATRIX MATERIALS) (RADIOACTIVITY), 113

LUBRICANT OXIDATION (ENGINE WEAR MATERIALS)
 Catalyst Package (CATALYST PACKAGE FOR LUBRICANT OXIDATION), 91

LUBRICATING OIL (ENGINE WEAR MATERIALS)
 Chlorine in LUBRICATING BASE OILS, 90
 Nitrogen in LUBRICATING BASE OILS, 90
 WEAR-METALS IN OIL, 91

LUNG (RADIOACTIVITY)
 Human (NATURAL MATRIX MATERIALS), 113

LUTETIUM
 SPECTROMETRY Solution, 50

M

MAGNESIUM
 Magnesium Gluconate Dihydrate (CLINICAL LABORATORY MATERIALS), 56
 Magnesium Metal (STABLE ISOTOPIC MATERIALS), 53
 SPECTROMETRY Solution, 50–52

MAGNETIC PARTICLE TEST RING (NONDESTRUCTIVE EVALUATION), 128

MAGNETIC TAPE (AUTOMATIC DATA PROCESSING)
 MAGNETIC COMPUTER STORAGE MEDIA, 129

MANGANESE
 Metals on Filter Media (MATERIALS ON FILTER MEDIA), 59
 SPECTROMETRY Solution, 50–52

D-MANNITOL

CLINICAL LABORATORY MATERIALS, 56

MARIJUANA METABOLITE

THC-9-COOH (DRUGS OF ABUSE IN URINE), 58

MARINE MATERIALS

Buffalo River Sediment (METAL . . . SEDIMENTS), 61
(SOILS AND SEDIMENTS), 84

Estuarine Sediment (METAL . . . SEDIMENTS), 61
(SOILS AND SEDIMENTS), 84

Limestone, Argillaceous (ROCKS AND MINERALS), 83

Limestone, Dolomitic (ROCKS AND MINERALS), 83

Mercury in Tennessee River Sediments (SOILS AND
SEDIMENTS), 84

Organics in Marine Sediment (ORGANIC
CONSTITUENTS), 69-74

Organics in Mussel Tissue (ORGANIC
CONSTITUENTS), 69-74

Oyster Tissue (FOODS AND BEVERAGES), 75

Polychlorinated Biphenyls (Congeners) in River Sediment A
(ORGANIC CONSTITUENTS), 69-74

MASS SPECTROMETRY

GC/MS AND LC SYSTEM PERFORMANCE
(ORGANICS), 69

See LIGHT STABLE ISOTOPIC MATERIALS, 55

See RADIOACTIVITY, 108-113

See STABLE ISOTOPIC MATERIALS, 53

MATERIALS ON FILTER MEDIA, 53

Arsenic

Barium

Beryllium

Cadmium

Chromium

Clay

Iron

Lead

Magnesium

Manganese

Nickel

Quartz

Selenium

Zinc

**MELTING POINT AND TRIPLE POINT (THERMODYNAMIC
PROPERTIES), 101****MERCAPTOBENZOTHAZOLE**

RUBBERS AND RUBBER-COMPOUNDING
MATERIALS, 98

MERCURY

Mercury (TOXIC SUBSTANCES IN URINE), 57

Mercury (Triple Point) (DEFINING FIXED POINT,
ITS-90), 101

NATURAL MATRIX MATERIALS
(RADIOACTIVITY), 113

SPECTROMETRY Solution, 50

in Tennessee River Sediments (SOILS AND
SEDIMENTS), 84

in TRACE ELEMENTS (FOSSIL FUELS), 66

Trace Mercury in Coal (METAL CONSTITUENTS), 58

in Water (METAL CONSTITUENTS), 58

METALLO-ORGANICS (ENGINE WEAR MATERIALS)

See METALLO-ORGANIC COMPOUNDS, 90

METALLURGY (MISCELLANEOUS PROPERTIES), 122

Austenite in Ferrite (X-RAY DIFFRACTION OF
FERROUS MATERIALS), 121

METALS ON FILTER MEDIA

See MATERIALS ON FILTER MEDIA, 59

METHANE (ANALYZED GASES)

Methane in Air (MIXTURES AND
POLLUTANTS), 63-65

METROLOGY

See GUIDE TO SRM/RM TECHNICAL
CATEGORIES, 19-21

MICROANALYSIS, 47**MICROCHEMISTRY (HIGH PURITY MATERIALS), 49**

Acetanilide

Anisic Acid

o-Bromobenzoic Acid

m-Chlorobenzoic Acid

Cystine

p-Fluorobenzoic Acid

Nicotinic Acid

Urea

MICROHARDNESS (SURFACE FINISH), 127

of Bright Copper

of Bright Nickel

MICROSCOPY (METROLOGY)

DEPTH PROFILING, 116

ELLIPSOMETRY, 118

OPTICAL MICROSCOPE LINEWIDTH

MEASUREMENT, 116

SCANNING ELECTRON MICROSCOPE (SEM), 116

MICROSPHERE (SIZING)

Glass Spheres (PARTICLE SIZE), 125

Polystyrene Spheres (PARTICLE SIZE), 125

MILK (FOOD AND AGRICULTURE)

Non-fat Milk Powder (FOODS AND
BEVERAGES), 75

MINERALS

See ROCKS AND MINERALS, 83

MIXTURES AND POLLUTANTS (ANALYZED GASES), 63-65

Aromatic Organic Gases in Nitrogen

Blood Gas—Carbon Dioxide and Nitrogen

Blood Gas—Carbon Dioxide, Oxygen, and Nitrogen

Carbon Dioxide in Nitrogen

Carbon Dioxide and Nitrous Oxide in Air

Carbon Monoxide in Air

Carbon Monoxide in Nitrogen

Carbon Monoxide and Propane in Nitrogen

Carbon Monoxide, Propane, and Carbon Dioxide
in Nitrogen

Methane in Air

Methane-Propane in Air

Methane in Nitrogen

Nitric Oxide in Nitrogen

Non-methane Organics in Nitrogen

Oxides of Nitrogen in Air

Oxygen in Nitrogen

Propane in Air

Carbon Dioxide in Air

Propane in Nitrogen

Propane in Nitrogen and Oxygen

Sulfur Dioxide in Nitrogen

Ambient Non-methane Organics in Nitrogen

Ambient Toxic Organics in Nitrogen

Hydrogen Sulfide in Nitrogen

MOLECULAR WEIGHT AND MELT FLOW (POLYMERIC PROPERTIES), 97-98

Polyethylene, Branched
Polyethylene Gas Pipe Resin
Polyethylene, Linear
Poly(ethylene oxide)
Polyethylene Resin
Poly(methylmethacrylate)
Polystyrene

See POLYETHYLENE PIPE PRODUCTS, 98

MOLYBDENUM

ENTHALPY AND HEAT CAPACITY, 99
as Molybdenum-99-Techetium-99m
(RADIOPHARMACEUTICALS), 110
SPECTROMETRY Solution, 50

N

NAVAL BRASS

See NONFERROUS METALS, 39-47

NDE

abbr. for Nondestructive Evaluation

NEODYMIUM

SPECTROMETRY Solution, 50

NEUTRON MONITOR (RADIOACTIVITY)

Neutron Density Monitor Wire (RADIATION DOSIMETRY), 108

NICKEL

as Nickel-63 (RADIOACTIVITY), 108-113

Nickel Cyclohexanebutyrate

(METALLO-ORGANIC COMPOUNDS), 90

Nickel (STABLE ISOTOPIC MATERIALS), 53

NICKEL BASE ALLOYS (NONFERROUS METALS), 39-47

NICKEL OXIDES (NONFERROUS METALS), 39-47

SPECTROMETRY Solution, 50-52

NICOTINIC ACID

MICROCHEMISTRY (STOICHIOMETRY), 49

NIOBIMUM

as Niobium-94 (RADIOACTIVITY), 108-113

SPECTROMETRY Solution, 50

NIST TIME SOFTWARE (METROLOGY)

Automated Computer Time Service (ACTS), 118

NITRATE

Single-component Solution (ANION CHROMATOGRAPHY), 53

NITRIC OXIDE

Nitric Oxide in Nitrogen (MIXTURES AND POLLUTANTS), 63-65

NITROGEN (MIXTURES AND POLLUTANTS), 63-65

Ambient Non-methane Organics in

Ambient Toxic Organics in

Aromatic Organic Gases in

Blood Gas in

Carbon Dioxide in

Carbon Monoxide in

Carbon Monoxide and Propane in

Carbon Monoxide, Propane, and Carbon Dioxide in

Hydrogen Sulfide in

Nitric Oxide in

Oxygen in

Propane in

Propane in Nitrogen and Oxygen

Sulfur Dioxide in

Total Nitrogen (LUBRICATING BASE OILS), 90

NITROUS OXIDE

Carbon Dioxide and Nitrous Oxide in Air
(MIXTURES AND POLLUTANTS), 63-65

4-NITROPHENOL

CLINICAL LABORATORY MATERIALS, 56

NONDESTRUCTIVE EVALUATION, 128

ARTIFICIAL FLAW FOR EDDY CURRENT NDE

DYE PENETRANT TEST BLOCKS

MAGNETIC PARTICLE INSPECTION

NONFERROUS ALLOYS

See NONFERROUS METALS, 39-47

NORTHERN SOFTWOOD

BLEACHED KRAFT PULPS, 122

NUCLEAR MATERIALS (RADIOACTIVITY), 108-113

ACCELERATOR MASS SPECTROMETRY

ALPHA PARTICLE POINT SOURCES

FISSION TRACK GLASS

GAMMA RAY POINT SOURCES

NATURAL MATRIX MATERIALS

RADIATION DOSIMETRY

RADIOACTIVE SOLUTIONS

RADIOPHARMACEUTICALS

RADON EMANATION

Carbon-14 DATING

See HIGH-PURITY MATERIALS, 48-55

NUTRITION

See FOODS AND BEVERAGES (FOOD AND AGRICULTURE), 75

O

OBSIDIAN ROCK

ROCKS AND MINERALS, 83

OIL

Chlorine in (LUBRICATING BASE OILS), 90

Fuel Oil (TRACE ELEMENTS) (FOSSIL FUELS), 68

High Sulfur Gas Oil Feed (CATALYST

CHARACTERIZATION MATERIALS), 90

Nitrogen (LUBRICATING BASE OILS), 90

Moisture in Oils (FOSSIL FUELS), 67

Organics in Cod Liver Oil (ORGANIC CONSTITUENTS), 69-74

Petroleum Crude Oil (ORGANIC CONSTITUENTS), 69-74

Polychlorinated Biphenyls in (ORGANIC CONSTITUENTS), 69-74

Shale Oil (ORGANIC CONSTITUENTS), 69-74

Sulfur in Distillate Fuel Oil (SULFUR IN FOSSIL FUELS), 67

Sulfur in Residual Fuel Oil (SULFUR IN FOSSIL FUELS), 67

Total Chlorine (LUBRICATING BASE OILS), 90

Total Nitrogen (LUBRICATING BASE OILS), 90

Vanadium in Crude Oil (METAL CONSTITUENTS) (INORGANICS), 61

Vanadium and Nickel in Residual Fuel Oil (METAL CONSTITUENTS) (INORGANICS), 61

WEAR-METALS IN OIL (ENGINE WEAR MATERIALS), 91

OPAL

Opal Glass (DIRECTIONAL HEMISPHERICAL REFLECTANCE), 107

Opal Powder (GLASSES) (CERAMICS AND GLASSES), 86

OPTICAL

See GUIDE TO SRM/RM TECHNICAL CATEGORIES, 19-21

OPTICAL FIBER GEOMETRY (METROLOGY), 116

ORES (GEOLOGICAL MATERIALS AND ORES), 79-84

Alumina (Reduction Grade)

Bauxite, Arkansas

Bauxite, Australian

Bauxite, Dominican

Bauxite, Jamaican

Bauxite, Surinam

Borate Ore

Chinese Ores

Copper Ore Mill Heads

Copper Ore Mill Tails

Fluorspar, Customs Grade

Fluorspar, High Grade

Gold Ore, Refractory

Iron Ore, Canada

Iron Ore, Labrador

Iron Ore, Nimba

Iron Ore, Sibley

Iron Oxide, Reduced

Lithium Ore (Lepidolite)

Lithium Ore (Petalite)

Lithium Ore (Spodumene)

Manganese Ore

Phosphate Rock, Florida

Phosphate Rock, Western

Pyrite Ore (ORE BIOLEACHING SUBSTRATE)

Rutile Ore

Scheelite Ore

Tungsten Concentrate

ORGANICS

ORGANIC CONSTITUENTS, 69-74

GC/MS AND LC SYSTEM PERFORMANCE, 69

OXALIC ACID (RADIOACTIVITY)

Carbon-14 Dating, 111

OXYGEN (MIXTURES AND POLLUTANTS), 63-65

Blood Gas

Oxygen in Nitrogen

OXYGEN CONCENTRATION IN SILICON (METROLOGY), 118

OXYGENATES

See FOSSIL FUELS, 66-68

OYSTER TISSUE

FOODS AND BEVERAGES, 75

P

PACKAGE

Catalyst Package (CATALYST PACKAGE FOR LUBRICANT OXIDATION), 91

PAINT

Powdered Lead Base Paint (LEAD IN PAINT), 60

PALLADIUM

SPECTROMETRY Solution, 50

PARTICLE SIZE (SIZING), 125

Glass Spheres

Polystyrene Spheres

PARTICULATES

Diesel Particulate Matter (ORGANIC CONSTITUENTS), 69-74

MATERIALS ON FILTER MEDIA (HEALTH AND INDUSTRIAL HYGIENE), 56-60

Urban Dust/Organics (ORGANIC CONSTITUENTS), 69-74

Urban Particulate (TRACE ELEMENTS) (INORGANICS), 61

pD (ION ACTIVITY), 95

Disodium Hydrogen Phosphate

Potassium Dihydrogen Phosphate

Potassium Hydrogen Phthalate

Sodium Bicarbonate

Sodium Carbonate

PERMEATION DEVICES (ANALYZED GASES), 63

Nitrogen Dioxide Permeation Tube

Sulfur Dioxide Permeation Tube

PERUVIAN SOIL (RADIOACTIVITY)

NATURAL MATRIX MATERIALS, 112

PESTICIDES (ORGANIC CONSTITUENTS), 68-73

Chlorinated Pesticides in Hexane

Chlorinated Pesticides in *Iso*octane

pH (ION ACTIVITY), 95

Calcium Carbonate

Disodium Hydrogen Phosphate

Potassium Dihydrogen Phosphate

Potassium Hydrogen Phthalate

Potassium Hydrogen Tartrate

Potassium Tetroxalate

Sodium Bicarbonate

Sodium Carbonate

Sodium Tetraborate Decahydrate

See BIOLOGICAL BUFFER SYSTEMS, 95

PHOSPHATE

See pD CALIBRATION, 95

See pH CALIBRATION, 95

Phosphate (ANION CHROMATOGRAPHY), 53

Phosphate Rock (ORES), 79-81

Triphenyl Phosphate (METALLO-ORGANIC COMPOUNDS), 90

PHOSPHORUS

as Phosphorus-32 (RADIOPHARMACEUTICALS), 110

SPECTROMETRY Solution, 50

PHOTOGRAPHY (PHOTOGRAPHY), 107

Microcopy Resolution Test Chart

PINE NEEDLES

AGRICULTURAL MATERIALS, 77

PLASTIC

See POLYMERIC PROPERTIES, 97-98

PLATINUM (HIGH PURITY METALS), 48

High-Purity Platinum

Pt, High Purity (THERMOCOUPLE MATERIAL), 102

SPECTROMETRY Solution, 50

PLUTONIUM (RADIOACTIVITY)

- Columbia River Sediment, 113
- Human Liver, 113
- Human Lung, 113
- Peruvian Soil, 113
- as Plutonium-238, 109
- as Plutonium-240, 109
- as Plutonium-241, 109
- as Plutonium-242, 109
- Rocky Flats Soil Number 1, 113

POLLUTANTS

- METAL CONSTITUENTS IN WATER AND SEDIMENTS (INORGANICS), 61
- MIXTURES AND POLLUTANTS (ANALYZED GASES), 63–65
- ORGANIC CONSTITUENTS (ORGANICS), 69–74
- SIMULATED RAINWATERS (INORGANICS), 61

POLONIUM (RADIOACTIVITY)

- as Polonium-208, 109

POLYCHLORINATED BIPHENYLS – PCBs

- (ORGANICS), 69–74
- Chlorinated Biphenyls
- Chlorinated Biphenyl Congeners in *Isooctane*
- Polychlorinated Biphenyl Congeners in *Isooctane*
- Polychlorinated Biphenyls in Human Serum
- Polychlorinated Biphenyls in Oil
- Polychlorinated Biphenyls in River Sediment A

POLYETHYLENE (MOLECULAR WEIGHT AND

MELT FLOW), 97

- Polyethylene, Branched
- Polyethylene Gas Pipe Resin
- Polyethylene, Linear
- Polyethylene Resin

POLYETHYLENE (POLYETHYLENE PIPE PRODUCTS), 98

- Polyethylene Butt T Joint
- Polyethylene Piping
- Polyethylene Socket T Joint

POLYMER

- See POLYMERIC PROPERTIES, 97–98

POLY(METHYLMETHACRYLATE) (POLYMERIC PROPERTIES)

- MOLECULAR WEIGHT AND MELT FLOW, 97

POLYSTYRENE

- ENTHALPY AND HEAT CAPACITY (THERMODYNAMIC PROPERTIES), 99–103
- MOLECULAR WEIGHT AND MELT FLOW (POLYMERIC PROPERTIES), 97–98

POTASSIUM

- SPECTROMETRY Solution, 50–52

POTASSIUM CHLORIDE

- CLINICAL LABORATORY MATERIALS, 56
- ELECTROLYTIC CONDUCTIVITY, 96
- ION-SELECTIVE ELECTRODE CALIBRATION, 96
- STABLE ISOTOPIC MATERIALS, 53
- SOLUTION CALORIMETRY, 99
- STOICHIOMETRY, 49

POTASSIUM DICHROMATE

- MOLECULAR . . . SPECTROMETRY, 104–106
- STOICHIOMETRY, 49

POTASSIUM DIHYDROGEN PHOSPHATE

- FERTILIZERS, 78
- pD CALIBRATION, 95
- pH CALIBRATION, 95

POTASSIUM HYDROGEN PHTHALATE

- pD CALIBRATION, 95
- pH CALIBRATION, 95
- STOICHIOMETRY, 49

POTASSIUM HYDROGEN TARTRATE

- pH CALIBRATION, 95

POTASSIUM IODIDE

- MOLECULAR . . . SPECTROMETRY, 104–106

POTASSIUM NITRATE

- FERTILIZERS, 78

POTASSIUM TETROXALATE

- pH CALIBRATION, 95

POWDERED LEAD BASE PAINT

- LEAD IN PAINT, 60

PRASEODYMIUM

- SPECTROMETRY Solution, 50

PRIMARY CHEMICALS

- STOICHIOMETRY, 49

PRIORITY POLLUTANT PAH

- ORGANIC CONSTITUENTS, 69–74

Q

QUARTZ

- MATERIALS ON FILTER MEDIA, 59
- Metal-on-Quartz Filters, Transmittance (MOLECULAR . . . SPECTROMETRY), 104–106

QUININE SULFATE DIHYDRATE

- MOLECULAR . . . SPECTROMETRY, 104–106

RADIOACTIVITY

- ACCELERATOR MASS SPECTROMETRY
- ALPHA PARTICLE POINT SOURCES
- FISSION TRACK GLASS
- GAMMA RAY POINT SOURCES
- NATURAL MATRIX MATERIALS
- RADIATION DOSIMETRY
- RADIOACTIVE SOLUTIONS
- RADIOPHARMACEUTICALS
- RADON EMANATION
- Carbon-14 DATING
- See HIGH-PURITY MATERIALS, 48–55

RADIUM (RADIOACTIVITY)

- as Radium-226 (RADIOACTIVE SOLUTIONS), 109
- as Radium-226 (RADON EMANATION), 112

RAINWATER

- SIMULATED RAINWATERS (INORGANICS), 61

RECYCLED ALUMINUM

- Cadmium and Lead Levels (ALUMINUM BASE ALLOYS), 39

REFERENCE FUELS

- ALCOHOLS AND ETHERS (FOSSIL FUELS), 66–68

REFLECTANCE (OPTICAL PROPERTIES)
 DIRECTIONAL HEMISPHERICAL
 REFLECTANCE, 107
 INFRARED REFLECTANCE, 107
 SPECULAR SPECTRAL REFLECTANCE, 107

REFRACTIVE INDEX (MISCELLANEOUS PROPERTIES)
 See DENSITY AND REFRACTIVE INDEX, 122

REFRACTORIES (GEOLOGICAL MATERIALS AND ORES)
 Burnt Refractory, 83

REFORMULATED GASOLINES
 See FOSSIL FUELS, 66-68

RESIDUAL RESISTIVITY RATIO (ELECTRICAL PROPERTIES)
 Aluminum, 115

RESISTANCE (THERMODYNAMIC PROPERTIES)
 THERMAL RESISTANCE OF GLASS AND SILICA, 103

RESISTIVITY (ELECTRICAL PROPERTIES)
 ELECTRICAL RESISTIVITY AND CONDUCTIVITY OF METALS, 114
 ELECTRICAL RESISTIVITY AND CONDUCTIVITY OF SILICON, 114
 RESIDUAL RESISTIVITY RATIO, 115

RHENIUM
 SPECTROMETRY Solution, 50

RHODIUM
 SPECTROMETRY Solution, 50

RICE FLOUR (FOOD AND AGRICULTURE)
 FOODS AND BEVERAGES, 75

RIVER SEDIMENT (SOILS AND SEDIMENTS), 84
 Buffalo River Sediment
 Estuarine Sediment
 Tennessee River

RIVER SEDIMENT (ORGANICS)
 Polychlorinated Biphenyls in River Sediment A (ORGANIC CONSTITUENTS), 69-74

RIVER SEDIMENT (RADIOACTIVITY)
 Columbia River Sediment (NATURAL MATRIX MATERIALS), 113

ROCKS
 Basalt Rock (ROCKS AND MINERALS), 83
 Obsidian Rock (ROCKS AND MINERALS), 83
 Phosphate Rock (Florida) (FERTILIZERS), 78
 Phosphate Rock (Western) (FERTILIZERS), 78
 Phosphate Rock (Western) (ORES), 79-81

ROCKY FLATS SOIL NUMBER 1 (RADIOACTIVITY)
 NATURAL MATRIX MATERIALS, 113

ROYAL CANADIAN MINT REFERENCE MATERIALS (HIGH PURITY MATERIALS), 54-55

RRR
 abbr. for Residual Resistivity Ratio

RUBBER (POLYMERIC PROPERTIES), 97-98
 Isobutylene-Isoprene (Butyl Rubber) (RUBBERS... MATERIALS)
 Styrene-Butadiene 1500 (RUBBERS... MATERIALS)

RUBBER COMPOUNDING MATERIALS (POLYMERIC PROPERTIES), 98
 Mercaptobenzothiazole (RUBBERS... MATERIALS)

Stearic Acid (RUBBERS... MATERIALS)
 Sulfur (RUBBERS... MATERIALS)

RUBIDIUM

Rubidium (MELTING POINT AND TRIPLE POINT), 101
 Rubidium Chloride (STABLE ISOTOPIC MATERIALS), 53
 SPECTROMETRY Solution, 50

S

SAMARIUM

SPECTROMETRY Solution, 51

SAND

See ROCKS AND MINERALS, 83

SCANDIUM

SPECTROMETRY Solution, 51

SCANNING ELECTRON MICROSCOPE (METROLOGY), 116

SEM Magnification Standard
 SEM Performance Standard

SCHEELITE ORE

ORES, 79-81

SEDIMENT

NATURAL MATRIX MATERIALS

(RADIOACTIVITY), 113

ORGANIC CONSTITUENTS (ORGANICS), 69-74

SOILS AND SEDIMENTS, 84

SELENIUM

as Selenium-75 (RADIOPHARMACEUTICALS), 110

Selenium, Intermediate Purity (HIGH PURITY METALS), 48

SPECTROMETRY Solution, 51-52

SEM

abbr. for Scanning Electron Microscope

SILICA

Fumed Silica Board (THERMAL RESISTANCE OF GLASS AND SILICA), 103

Fused Silica (THERMAL EXPANSION OF GLASS AND SILICA), 103

Lead Silica Glass (DENSITY AND REFRACTIVE INDEX), 122

Respirable Cristobalite (RESPIRABLE SILICA), 60

Silica Brick (REFRACTORIES), 83

SILICON

Carbon Modified Silicon (INORGANICS), 62

ELECTRICAL RESISTIVITY AND CONDUCTIVITY OF SILICON, 114

Octaphenylcyclotetrasiloxane (METALLO-ORGANIC COMPOUNDS), 90

Silicon (STABLE ISOTOPIC MATERIALS), 53

Silicon Carbide (CARBIDES), 85

Silicon Metal (STEELMAKING ALLOYS), 36

Silicon Powder (X-RAY DIFFRACTION), 121

SPECTROMETRY Solution, 51

See STEELMAKING ALLOYS, 36

SILICON DIOXIDE

Thin Film Thickness (ELLIPSOMETRY), 118

SILVER

- Alloy (METALS)/(MICROANALYSIS), 47
- Royal Canadian Mint Reference Materials, 54–55
- Silver 2-ethylhexanoate (METALLO-ORGANIC MATERIALS), 90
- Silver Nitrate (STABLE ISOTOPIC MATERIALS), 53
- SPECTROMETRY Solution, 51–52

SINUSOIDAL ROUGHNESS

- SURFACE ROUGHNESS (SURFACE FINISH), 127

SIZING

- CEMENT TURBIDIMETRY AND FINENESS, 125
- PARTICLE SIZE, 125
- SURFACE AREA OF POWDERS, 126

SMOKE (FIRE RESEARCH), 130

- SMOKE DENSITY CHAMBER
- SMOKE TOXICITY

SOCKETED BALL BAR (MISCELLANEOUS PERFORMANCE . . . MATERIALS)

- Socketed Ball Bar, 131

SODA LIME GLASS (CERAMICS AND GLASSES), 86

- Soda-Lime, Container (GLASSES)
- Soda-Lime, Flat (GLASSES)
- Soda-Lime, Float (GLASSES)
- Soda-Lime, Sheet (GLASSES)

SODIUM

- Disodium Hydrogen Phosphate (ION ACTIVITY), 95–96
- Sodium Bicarbonate (ION ACTIVITY), 95–96
- Sodium Carbonate (ION ACTIVITY), 95–96
- Sodium Chloride (CLINICAL LABORATORY MATERIALS), 56
- Sodium Cyclohexanecarboxylate (METALLO-ORGANIC MATERIALS), 90
- Sodium Oxalate (STOICHIOMETRY), 49
- Sodium Pyruvate (CLINICAL LABORATORY MATERIALS), 56
- Sodium Tetraborate Decahydrate (ION ACTIVITY), 95–96
- SPECTROMETRY Solution, 51–52

SOILS

- Trace Elements in SOILS AND SEDIMENTS, 84

SOLDER (METROLOGY)

- Sn-Pb Alloy (SOLDER THICKNESS), 117

SPECIATION

- Chromium Species, 53

SPECTRAL REFLECTANCE

- See OPTICAL PROPERTIES, 104–107

SPHERES (SIZING)

- PARTICLE SIZE, 125

SPECTROMETRY

- SINGLE ELEMENT solutions (HIGH PURITY MATERIALS), 50–51
- MULTI-ELEMENT Solutions (HIGH PURITY MATERIALS), 51–52
- See MOLECULAR . . . SPECTROMETRY (OPTICAL PROPERTIES), 104–106

SPECULAR SPECTRAL REFLECTANCE

- (OPTICAL PROPERTIES), 107
- First Surface, Aluminum on Glass

First Surface, Black Glass

First Surface, Gold on Glass

Second Surface, Aluminum on Fused Quartz

STAINLESS STEEL

See FERROUS METALS, 25–38

STEARIC ACID

RUBBERS AND RUBBER-COMPOUNDING MATERIALS, 98

STEELS (FERROUS METALS)

See GUIDE TO SRM/RM TECHNICAL CATEGORIES, 19–21

STRONTIUM

- as Strontium-90 (RADIOACTIVITY), 108–113
- Strontium Carbonate (STOICHIOMETRY), 49
- Strontium Carbonate (STABLE ISOTOPIC MATERIALS), 53
- Strontium Cyclohexanecarboxylate (METALLO-ORGANIC MATERIALS), 90
- SPECTROMETRY Solution, 51–52

STYRENE BUTADIENE

RUBBER AND RUBBER-COMPOUNDING MATERIALS, 98

SUCCINONITRILE

MELTING POINT AND TRIPLE POINT (THERMODYNAMIC PROPERTIES), 101

SUCROSE

- OPTICAL ROTATION, 107
- STOICHIOMETRY, 49

SULFATE

ANION CHROMATOGRAPHY, 53

SULFIDE (ANALYZED GASES)

Hydrogen Sulfide in Nitrogen (MIXTURES AND POLLUTANTS), 63–65

SULFUR

- CATALYST CHARACTERIZATION MATERIALS, 90
- RUBBERS AND RUBBER-COMPOUNDING MATERIALS, 98
- SPECTROMETRY Solution, 48
- SULFUR IN FOSSIL FUELS, 67
- WEAR-METALS IN OIL, 91

SULFUR DIOXIDE (ANALYZED GASES)

- Sulfur Dioxide in Nitrogen (MIXTURES AND POLLUTANTS), 63–65
- Sulfur Dioxide Permeation Tube (PERMEATION DEVICES), 65

SUPERCONDUCTIVE (THERMODYNAMIC PROPERTIES)

Superconductive Thermometric Fixed Point Device, 100

SURFACE AREA (SIZING)

SURFACE AREA OF POWDERS, 126

SURFACE FINISH, 127

- ABRASIVE WEAR
- CHARPY V-NOTCH TEST BLOCKS
- CORROSION
- MICROHARDNESS
- SURFACE ROUGHNESS

SURFACE FLAMMABILITY (FIRE RESEARCH)

Hardboard Sheet, 130

T

TANTALUM

SPECTROMETRY Solution, 51

TAPE ADHESION TESTING

Linerboard for Tape Adhesion Testing, 131

TECHNETIUM

as Technetium-99m

(RADIOPHARMACEUTICALS), 110

TELLURIUM

SPECTROMETRY Solution, 51

TEM

abbr. for Transmission Electron Microscope

TERBIUM

SPECTROMETRY Solution, 51

TETRACHLOROETHYLENE (ANALYZED GASES)

MIXTURES AND POLLUTANTS, 63-65

TETRAHYDROCANNABIONOL (Marijuana Metabolite)

THC-9-COOH (DRUGS OF ABUSE IN URINE), 58

THALLIUM

SPECTROMETRY Solution, 51

as Thallium-201 (RADIOPHARMACEUTICALS), 110

THC

abbr. for Tetrahydrocannabinol

THERMAL ANALYSIS (THERMODYNAMIC PROPERTIES)

COMBUSTION CALORIMETRY, 99

DIFFERENTIAL SCANNING CALORIMETRY, 100

DIFFERENTIAL THERMAL ANALYSIS, 100

ENTHALPY AND HEAT CAPACITY, 99

SOLUTION CALORIMETRY, 99

THERMAL CONDUCTIVITY (THERMODYNAMIC PROPERTIES), 103

Electrolytic Iron

Graphite

Sintered Tungsten

Stainless Steel

THERMAL EXPANSION (THERMODYNAMIC PROPERTIES), 103

Borosilicate Glass

Copper

Fused Silica

Stainless Steel (AISI 446)

THERMAL RESISTANCE (THERMODYNAMIC PROPERTIES), 103

Fibrous Glass Blanket

Fibrous Glass Board

Fumed Silica Board

THERMOGRAVIMETRY (THERMODYNAMIC PROPERTIES)

See DIFFERENTIAL THERMAL ANALYSIS, 100

THERMOMETER (THERMODYNAMIC PROPERTIES)

Clinical Laboratory Thermometer, 102

THERMOMETRIC FIXED POINTS (THERMODYNAMIC PROPERTIES)

DEFINING FIXED POINT, ITS-90, 101

MELTING POINT AND TRIPLE POINT, 101

Superconductive Thermometric Fixed Point Device, 100

THIANTHRENE

COMBUSTION CALORIMETRY, 99

THICKNESS (METROLOGY)

COPPER AND CHROMIUM COATING ON STEEL, 117

ELLIPSOMETRY, 118

GOLD COATING ON FE-NI-CO ALLOY, 117

SOLDER THICKNESS, 117

THORIUM

as Thorium-229 (RADIOACTIVITY), 108-113

SPECTROMETRY Solution, 51

THULIUM

SPECTROMETRY Solution, 51

TIME SERVICE DISKETTE (METROLOGY)

NIST TIME SOFTWARE, 118

TIN

DEFINING FIXED POINT, ITS-90, 101

Dibutyltin bis (2-ethylhexanoate) (METALLO-ORGANIC COMPOUNDS), 90

DIFFERENTIAL SCANNING CALORIMETRY, 100

DIFFERENTIAL THERMAL ANALYSIS, 100

SPECTROMETRY Solution, 51

TITANIUM

GASES IN METALS (NONFERROUS METALS), 46

SPECTROMETRY Solution, 51

TITANIUM BASE ALLOYS (NONFERROUS METALS), 45

TITANIUM DIOXIDE

REFRACTORIES, 83

TOLUENE

DENSITY AND REFRACTIVE INDEX, 122

TOXIC METALS

TOXIC SUBSTANCES IN URINE, 57

TRACE ELEMENTS

See CERAMICS AND GLASSES, 87

See FOSSIL FUELS, 68

See TRACE ELEMENTS IN NICKEL BASE SUPERALLOYS, 44

TRANSMISSION ELECTRON MICROSCOPE

See THIN FILM FOR TRANSMISSION

ELECTRON MICROSCOPE, 47

See ASBESTOS, 60

TRANSMITTANCE

See MOLECULAR . . . SPECTROMETRY, 104-106

TRIPLE POINT AND MELTING POINT

(THERMODYNAMIC PROPERTIES), 99-103

2,2,4-TRIMETHYLPENTANE (ISOOCTANE)

REFERENCE LIQUIDS FOR RATING FUELS, 67

TRIPALMITIN

CLINICAL LABORATORY MATERIALS, 56

TRIS(HYDROXYMETHYL)AMINOMETHANE

SOLUTION CALORIMETRY, 99

STOICHIOMETRY, 49

TUNGSTEN

Sintered Tungsten (THERMAL CONDUCTIVITY OF GRAPHITE AND METALS), 103

SPECTROMETRY Solution, 51

Tungsten Carbide (CARBIDES), 85

Tungsten Concentrate (ORES), 79-81

TURBIDIMETRY (SIZING)

Portland Cement (CEMENT TURBIDIMETRY
AND FINENESS), 125

U**UNIVERSITY OF PITTSBURGH I (FIRE RESEARCH)**

See SMOKE TOXICITY, 130

URANIUM

SPECTROMETRY Solution, 51

URANIUM (RADIOACTIVITY)

as Uranium-232, 109

as Uranium-238, 109

Fission Track Glass, 108

NATURAL MATRIX MATERIALS, 112

UREA

CLINICAL LABORATORY MATERIALS, 56

COMBUSTION CALORIMETRY (THERMODYNAMIC
PROPERTIES), 99

in Human Serum (SERUM MATERIALS), 57

MICROCHEMISTRY, 49

URIC ACID

CLINICAL LABORATORY MATERIALS, 56

**URINE, FREEZE-DRIED (HEALTH AND INDUSTRIAL
HYGIENE), 56-60**

Cocaine and Metabolites in

Cotinine in

Fluoride in

Mercury in

Morphine and Codeine in

Multi-drugs of Abuse in

THC (Marijuana Metabolite) in

Toxic Metals in

V**VANADIUM**

Bis(1-phenyl-1,3-butanediono)oxovanadium (IV)
(METALLO-ORGANIC COMPOUNDS), 90

SPECTROMETRY Solution, 51

Vanadium in Crude Oil (METAL CONSTITUENTS IN
FOSSIL FUELS), 66

Vanadium and Nickel in Residual Fuel Oil (METAL
CONSTITUENTS IN FOSSIL FUELS), 66

**VAPOR PRESSURE OF METALS (THERMODYNAMIC
PROPERTIES), 102**

Cadmium

Gold

VICKERS (MICROHARDNESS) (SURFACE FINISH), 127

Bright Copper

Bright Nickel

VISCOSITY OF GLASS (CERAMICS AND GLASSES)

VISCOSITY FIXPOINTS, 120

VISCOSITY OF GLASS, 119

VITAMINS

Cholesterol and FSV in Coconut Oil (FOODS AND
BEVERAGES), 75

Fat Soluble Vitamins in Human Serum (CLINICAL
LABORATORY MATERIALS), 56

VMA

aka. 4-hydroxy-3-methoxymandelic acid

W**WASPALLOY**

NICKEL BASE ALLOYS (NONFERROUS
METALS), 44

WATER ANALYSIS

ANION CHROMATOGRAPHY in, 53

Mercury in Water (METAL CONSTITUENTS IN
WATER AND SEDIMENTS), 61

SIMULATED RAINWATERS (INORGANICS), 61

WAVELENGTH (OPTICAL PROPERTIES)

Holmium-oxide Solution (MOLECULAR . . .
SPECTROMETRY), 104-106

WEAR (SURFACE FINISH)

D-2 Tool Steel (ABRASIVE WEAR), 127

WEAR-METALS (ENGINE WEAR MATERIALS)

WEAR METALS IN OIL, 91

WHALE BLUBBER (ORGANICS)

ORGANIC CONSTITUENTS, 69-74

WHEAT

Wheat Straw (BIOMASS MATERIALS), 78

WHEAT FLOUR (FOOD AND AGRICULTURE)

FOODS AND BEVERAGES, 75

USA/CANADA COLLABORATIVE MATERIALS, 76

X**XENON (RADIOACTIVITY)**

as Xenon-133 (RADIOPHARMACEUTICALS), 110

X-RAY

THIN FILMS FOR X-RAY FLUORESCENCE
(INORGANICS), 61

X-RAY DIFFRACTION OF FERROUS
MATERIALS, 121

X-RAY DIFFRACTION, 121

X-RAY STAGE CALIBRATION, 121

Y**YEAST, BREWERS (FOOD AND AGRICULTURE)**

FOODS AND BEVERAGES, 75

YTTERBIUM

SPECTROMETRY Solution, 51

YTTRIUM

SPECTROMETRY Solution, 51

Z**ZINC**

DEFINING FIXED POINT, ITS-90, 101

DIFFERENTIAL SCANNING CALORIMETRY, 100

METALS (HIGH PURITY METALS), 48

Metals on Filter Media (MATERIALS ON FILTER

MEDIA), 59

SPECTROMETRY Solution, 51-52

Spelter (ZINC BASE ALLOYS), 46

ZINC BASE ALLOYS (NONFERROUS METALS), 46

Zinc Cyclohexanecarboxylate (METALLO-ORGANIC
COMPOUNDS), 90

ZIRCONIUM

SPECTROMETRY Solution, 51

ZIRCONIUM BASE ALLOYS (NONFERROUS
METALS), 46

Numerical and Certificate Index

SRM	Descriptor	Cert. Date	Section Code	Page	SRM	Descriptor	Cert. Date	Section Code	Page
1c	Limestone, Argillaceous	Mar 90	111	83	101g	Stainless Steel (AISI 304L)	Aug 86	101	29
4L	Cast Iron	Jun 90	101	37	106b	LA Steel, Cr-Mo-Al (Nitr alloy G)	Mar 61	101	26
RM 5	Cu Low Temp Heat Capacity	Mar 92	203	99	107c	Cast Iron (Ni-Cr-Mo)	May 83	101	37
6g	Cast Iron	Nov 70	101	37	112b	Silicon Carbide	Nov 87	112	85
7g	Cast Iron Hi-Phos.	Oct 59	101	37	114p	Portland Cement	May 94	301	125
8j	Carbon Steel, 0.1 C	Apr 72	101	25	115a	Cast Iron (Cu-Ni-Cr)	Apr 62	101	37
11h	Carbon Steel, 0.2 C	Feb 92	101	25	120c	Phosphate Rock (Florida)	Feb 88	110/111	78/80
12h	Carbon Steel, 0.4 C	Mar 66	101	25	121d	Stainless Steel, Cr-Ni-Ti (AISI 321)	Aug 81	101	29
13g	Carbon Steel, 0.6 C	Apr 74	101	25	122i	Cast Iron	Sep 92	101	37
14g	Carbon Steel, 0.8 C	Mar 90	101	25	123c	Stainless Steel, Cr-Ni-Nb (AISI 348)	Oct 81	101	29
15h	Carbon Steel, 0.1 C	Jun 93	101	25	125b	LA Steel, High Silicon	Feb 82	101	26
16f	Carbon Steel, 1.0 C	Jul 93	101	25	126c	HA Steel, High Nickel	Dec 77	101	28
17d	Sucrose (Polarimetric)	Sep 93	104/204	49/107	127b	Solder, 40Sn-60Pb	Aug 90	102	43
19h	Carbon Steel, 0.2 C	Sep 87	101	25	129c	LA Steel, High Sulfur (SAE 112)	Aug 73	101	26
20g	Carbon Steel	Oct 70	101	25	131e	LA Steel, High Silicon	Nov 91	101	26
25d	Manganese Ore	Feb 84	111	80	132b	Tool Steel (AISI M2)	Aug 73	101	29
27f	Iron Ore, Sibley	Dec 91	111	80	133b	Stainless Steel, Cr-13, Mo-0.3, S-0.3	Aug 81	101	29
30f	LA Steel, Cr-V (SAE 6150)	Mar 92	101	26	134a	Tool Steel, Mo-W-Cr-V	May 57	101	29
32e	LA Steel, Ni-Cr (SAE 3140)	Apr 57	101	26	136e	Potassium Dichromate (Oxidimetric)	Jun 89	104	49
33e	LA Steel, Ni-Mo (SAE 4820)	Mar 95	101	26	139b	LA Steel, Cr-Ni-Mo (AISI 8640)	Jun 93	101	26
36b	LA Steel, Cr-Mo	Jul 69	101	26	141d	Acetanilide	In Prep	104	49
39i	Benzoic Acid (Combustion Cal.)	Jul 68	203	99	142	Anisic Acid	Jul 69	104	49
40h	Sodium Oxalate (Reductometric)	May 92	104	49	143c	Cystine	Nov 91	104	49
41c	Dextrose (D-Glucose) (Polarimetric)	May 93	104/204	49/107	148	Nicotine Acid	Dec 70	104	49
45d	Cu (Freezing Point)	Apr 90	203	101	152a	Carbon Steel, 0.5 C	Oct 65	101	25
49e	Lead (Freezing Point)	Apr 90	203	101	154b	Titanium Dioxide	Sep 91	111	83
50c	Tool Steel, W-Cr-V	Jun 57	101	29	155	LA Steel, Cr-W	Oct 46	101	26
53e	Bearing Metal (Pb-Sb-Sn)	Jan 70	102	43	158a	Bronze, Silicon	Aug 61	102	40
54d	Bearing Metal (Tin Base)	Sep 57	102	44	160b	Stainless Steel, Cr-Ni-Mo (AISI 316)	Jul 86	101	29
57a	Silicon Metal	May 93	101	36	163	LA Steel, 1.0 C	Jan 68	101	26
58a	Ferrosilicon (73% Si)	Apr 78	101	36	165a	Glass Sand (Low Iron)	Nov 92	111/112	83/86
59a	Ferrosilicon	Nov 69	101	36	166c	Stainless Steel, Carbon Only	Mar 70	101	29
64c	Ferrochromium, High Carbon	Feb 92	101	36	173b	Titanium Alloy Al-V	Dec 84	102	45
68c	Ferromanganese, High Carbon	Aug 79	101	36	176	Titanium Alloy Al-Sn	Oct 81	102	45
69b	Bauxite (Arkansas)	Jan 91	111	80	178	Carbon Steel, 0.4 C	Jul 69	101	25
70a	Feldspar, Potash	Nov 90	111	83	179	LA Steel, High Silicon	May 94	101	26
72g	LA Steel (AISI 4130)	Jun 81	101	26	180	Fluorspar, High Grade	Aug 86	111	79
73c	Stainless Steel, Cr (SAE 420)	Feb 92	101	29	181	Lithium Ore (Spodumene)	Oct 81	111	79
76a	Burnt Refractory (Al2O3-40%)	Mar 92	111	83	182	Lithium Ore (Petalite)	Oct 81	111	79
77a	Burnt Refractory (Al2O3-60%)	Mar 92	111	83	183	Lithium Ore (Lepidolite)	Oct 81	111	79
78a	Burnt Refractory (Al2O3-70%)	Mar 92	111	83	185g	Potassium Hydrogen Phthalate, pH	Feb 91	201	95
79a	Fluorspar, Customs Grade	Jan 80	111	79	186le	Potassium Dihydrogen Phosphate, pH	Feb 91	201	95
81a	Glass Sand	Jan 78	111/112	83/86	186IIe	Disodium Hydrogen Phosphate, pH	Feb 91	201	95
82b	Cast Iron (Ni-Cr)	Apr 66	101	37	187c	Sodium Tetraborate (Borax), pH	May 93	201	95
83d	Arsenic Trioxide (Reductometric)	Mar 82	104	49	188	Potassium Hydrogen Tartrate, pH	May 87	201	95
84j	Potassium Hydrogen Phthalate	Jan 93	104	49	189a	Potassium Tetroxalate, pH	Feb 91	201	95
87a	Aluminum-Silicon Alloy	Jan 91	102	39	191a	Sodium Bicarbonate, pH	Jul 93	201	95
88b	Limestone, Dolomite	Apr 86	111	83	192a	Sodium Carbonate, pH	Jul 93	201	95
89	Glass, Lead Barium	Dec 90	112	86	193	Potassium Nitrate	Nov 91	110	78
90	Ferrophosphorus	Oct 28	101	36	194	Ammonium Dihydrogen Phosphate	Sep 92	110	78
91	Glass, Opal Powder	Oct 82	112	86	195	Ferrosilicon (75% Si-HP Grade)	Apr 78	101	36
92	Low-Boron, Soda-Lime Powder	Mar 82	112	86	196	Ferrochromium, Low Carbon	Nov 70	101	36
93a	High-Boron Borosilicate	Sep 91	112	86	198	Silica Brick	Jan 60	111	83
94c	Zinc-Base Die Casting Alloy	Dec 94	102	46	199	Silica Brick	Jan 91	111	83
97b	Flint Clay	Apr 88	111	82	200	Potassium Dihydrogen Phosphate	Aug 74	110	78
98b	Plastic Clay	Apr 88	111	82	211d	Toluene	In Prep	209	122
99a	Feldspar, Soda	Nov 90	111	83	276b	Tungsten Carbide	Jun 94	112	85
100b	LA Steel, Manganese (SAE (T340))	Aug 59	101	26	277	Tungsten Concentrate	Oct 78	111	79

SRM	Descriptor	Cert. Date	Section Code	Page	SRM	Descriptor	Cert. Date	Section Code	Page
278	Obsidian Rock	Mar 92	111	83	621	Soda-Lime Container	Jan 82	112	86
291	LA Steel, Cr-Mo (ASTM A 213)	Oct 75	101	26	622	Soda-Lime Silica (Durability)	Mar 76	208	119
293	LA Steel, Cr-Ni-Mo (ASTM 8620)	Mar 75	101	26	623	Borosilicate (Durability)	Mar 76	208	119
330	Copper Ore Mill Heads	Aug 91	111	79	624	Lead-Silica, for dc resistivity	Oct 77	207	119
331	Copper Ore Mill Tails	Sep 91	111	79	625	Zinc-Base A	Apr 64	102	46
334	Gray Cast Iron (Carbon & Sulfur)	Mar 82	101	37	626	Zinc-Base B	Apr 64	102	46
337a	Carbon Steel, 1.1 C (Carbon & Sulfur)	Apr 85	101	25	627	Zinc-Base C	Apr 64	102	46
338	White Cast Iron (Carbon & Sulfur)	May 93	101	37	628	Zinc-Base D	Apr 64	102	46
339	Stainless Steel, Cr-Ni-Se (SAE 303Se)	Jul 65	101	29	629	Zinc-Base E	Apr 64	102	46
341	Ductile Cast Iron	Mar 62	101	37	630	Zinc-Base F	Apr 64	102	46
342a	Nodular Cast Iron	Mar 92	101	37	631	Zinc Spelter (mod.)	Feb 95	102	46
343a	Stainless Steel (AISI 431)	Jun 94	101	29	640b	Line Position, Silicon (XRD)	Jan 87	209	121
344	HA Steel, (Mo Precipitation Hardening)	Oct 63	101	28	641	Ti-Alloy, 8 Mn (A)	Oct 81	102	45
345a	HA Steel, (Cu Precipitation Hardening)	Jun 92	101	28	642	Ti-Alloy, 8 Mn (B)	Oct 81	102	45
346a	Valve Steel	Feb 92	101	28	643	Ti-Alloy, 8 Mn (C)	Oct 81	102	45
347	Magnesium Ferrosilicon	Aug 90	101	36	644	Ti-Alloy, Cr-Fe-Mo	Jan 60	102	45
348a	Hi Temp. Alloy, (A286) Ni-Cr	Mar 87	101	28	647	Ti Alloy, Al-Mo-Sn-Zr	Aug 86	102	45
349a	Waspalloy	Jun 87	102	44	648	Ti Alloy, Al-Sn-Zr-Cr-Mo	Jun 87	102	45
350a	Benzoic Acid	Mar 95	104	49	649	Ti Alloy, V-Al-Cr-Sn	Jul 90	102	45
352c	Unalloyed Ti, Hydrogen	Jun 90	102	46	650	Unalloyed Titanium A	Nov 85	102	45
360b	Zircaloy 4, Zr-Base Alloy	Apr 86	102	46	651	Unalloyed Titanium B	Nov 85	102	45
361	LA Steel (AISI 4340)	Feb 81	101	27	652	Unalloyed Titanium C	Nov 85	102	45
362	LA Steel (AISI 94B17) (mod.)	Jun 89	101	27	654b	Ti Alloy, Al-V	Sep 91	102	45
363	LA Steel, Cr-V (mod.)	Feb 81	101	27	656	Quartz Analysis, SiN (XRD)	Mar 95	209	121
364	LA Steel, High C (mod.)	May 93	101	27	659	Silicon Nitride, Particle Size	Mar 92	301	125
367	Stainless Steel (AISI 446)	Mar 95	101	29	660	Line Profile, LaB6 (XRD)	Jun 89	209	121
368	Carbon Steel (AISI 1211)	Jan 78	101	25	661	LA Steel (AISI 4340)	Dec 91	101	30
371h	Sulfur (Rubber Compound)	N/A	202	98	663	LA Steel, Cr-V (mod.)	Dec 91	101	30
372i	Stearic Acid (Rubber Compound)	N/A	202	98	664	LA Steel, High Carbon, (mod.)	Dec 91	101	30
383a	Mercaptobenzothiazole	N/A	202	98	665	Electrolytic Iron	Dec 91	101	30
386k	Styrene-Butadiene/500	Oct 92	202	98	670	Rutile Ore	Jan 93	111	80
393	Unalloyed Copper-"O" (chips)	Sep 80	102	42	671	Nickel Oxide 1	Sep 60	102	45
394	Unalloyed Copper I (chips)	Apr 86	102	42	672	Nickel Oxide 2	Sep 60	102	45
395	Unalloyed Copper II (chips)	Jul 93	102	42	673	Nickel Oxide 3	Sep 60	102	45
396	Unalloyed Copper III (chips)	Apr 86	102	42	674a	Quant. Analysis, Set (XRD)	Jan 89	209	121
398	Unalloyed Copper V (chips)	Jul 93	102	42	675	Line Position, Mica (XRD)	Jun 82	209	121
399	Unalloyed Copper VI (chips)	Jul 93	102	42	676	Quantitative Analysis, Alumina (XRD)	May 92	209	121
400	Unalloyed Copper VII (chips)	Apr 86	102	42	679	Brick Clay	Jan 87	111	82
454	Unalloyed Copper XI (chips)	Apr 86	102	42	680aL1	High-Purity Platinum	Mar 77	104	48
457	Unalloyed Copper IV (solid)	Apr 86	102	42	680aL2	High-Purity Platinum	Mar 77	104	48
458	Beryllium-Copper (17510)	Sep 92	102	40	682	High-Purity Zinc	Jan 88	104	48
459	Beryllium-Copper (17200)	Sep 92	102	40	683	Zinc, Metal	Jan 85	104	48
460	Beryllium-Copper (17300)	Sep 92	102	40	685R	High-Purity Gold	Oct 81	104	48
473	Optical Linewidth	May 92	207	116	685W	High-Purity Gold	Oct 81	104	48
475	Optical Linewidth	Jan 92	207	116	688	Basalt Rock	Aug 81	111	83
476	Optical Linewidth	Sep 90	207	116	689	Ferrochromium Silicon	Feb 82	101	36
480	Tungsten-Molybdenum EPMA	Nov 68	103	47	690	Iron Ore Canada	Jun 92	111	80
481	Gold-Silver EPMA	Feb 69	103	47	691	Iron Oxide, Reduced	Oct 91	111	80
482	Gold-Copper EPMA	Aug 88	103	47	692	Iron Ore, Labrador	Jan 92	111	80
484g	SEM Magnification	In Prep	207	116	693	Iron Ore, Nimba	Jul 90	111	80
487	Austenite in Ferrite, 30%	May 82	209	121	694	Phosphate Rock, Western	Sep 93	110/111	78/81
488	Austenite in Ferrite, 2.5%	Apr 93	209	121	696	Bauxite, Surinam	Jan 91	111	81
494	Unalloyed Copper I (solid)	Apr 86	102	42	697	Bauxite, Dominican	Jan 91	111	81
495	Unalloyed Copper II (solid)	Oct 87	102	42	698	Bauxite, Jamaican	Jan 91	111	81
496	Unalloyed Copper III (solid)	Apr 86	102	42	699	Alumina (Reduction Grade)	Dec 93	111	81
498	Unalloyed Copper V (solid)	May 93	102	42	705a	Polystyrene	Jul 90	202/203	97/99
499	Unalloyed Copper VI (solid)	Mar 86	102	42	706	Polystyrene	Feb 79	202	97
500	Unalloyed Copper VII (solid)	Mar 86	102	42	709	Extra Dense Lead	Jun 74	208	120
600	Bauxite, Australian	Jan 91	111	80	710a	Soda-Lime Silica Glass	Mar 91	208	119/120
607	Potassium Feldspar	May 73	112	87	711	Lead-Silica Glass	Jul 64	208	119/120
610	Trace Elements in Glass	Jan 92	112	87	712	Mixed Alkali Lead Silicate Glass	Oct 65	208	120
611	Trace Elements in Glass	Jan 92	112	87	713	Dense Barium Crown Glass 620/603	Oct 65	208	120
612	Trace Elements in Glass	Jan 92	112	87	714	Alkaline Earth Glass	Oct 65	208	120
613	Trace Elements in Glass	Jan 92	112	87	716	Neutral Glass	Sep 66	208	120
614	Trace Elements in Glass	Jan 92	112	87	717	Borosilicate	Nov 69	208	120
615	Trace Elements in Glass	Jan 92	112	87	717a	Borosilicate	In Prep	208	119
616	Trace Elements in Glass	Jan 92	112	87	720	Synthetic Sapphire (Heat Capacity)	Apr 82	203	99
617	Trace Elements in Glass	Jan 92	112	87	723b	Tris (Basimetric)	Apr 93	104	49
620	Soda Lime, Flat	Jan 82	112	86	724a	Tris (Heat of Soln.)	Sep 73	203	99

SRM	Descriptor	Cert. Date	Section Code	Page
726	Selenium, Intermediate Purity	Jan 67	104	48
728	Zinc, Intermediate Purity	In Prep	104	48
731L1	Borosilicate Glass (Therm. Expansion)	Jul 93	203	103
731L2	Borosilicate Glass (Therm. Expansion)	Jul 93	203	103
731L3	Borosilicate Glass (Therm. Expansion)	Jul 93	203	103
736L1	Copper Therm. Exp.	Oct 90	203	103
738	Stainless Steel (Ther. Expansion)	May 93	203	103
739L1	Fused Silica (Ther. Resist.)	Dec 91	203	103
739L2	Fused Silica (Ther. Resist.)	Dec 91	203	103
739L3	Fused Silica (Ther. Resist.)	Dec 91	203	103
740a	Zinc (Freezing Point)	Nov 90	203	101
741a	Tin (Freezing Point)	In Prep	203	101
742	Alumina (Reference Point)	Jul 90	203	101
743	Mercury (Triple Point)	Jul 90	203	101
745	Gold-Vapor Pressure	Aug 90	203	102
746	Cadmium-Vapor Pressure	Jan 91	203	102
767a	Thermometric Fixed Point	Feb 92	203	100
769	Aluminum (Residual Resist. Ratio)	Nov 82	206	115
773	Soda-Lime-Silica (Glass Liquidus)	Nov 80	208	120
774	Lead-Silica (Dielectric Constant)	Jul 82	208	119
781-D2	Molybdenum (Heat Capacity)	Apr 77	203	99
855a	Aluminum Casting Alloy 356	Jan 90	102	39
856a	Aluminum Casting Alloy 380	Jan 90	102	39
858	Aluminum Alloy 6011	Mar 95	102	39
859	Aluminum Alloy 7075	Jun 80	102	39
862	High Temp. Alloy L605	Oct 91	101/102	28/39
864	Inconel, 600	May 84	102	44
865	Inconel, 625	May 84	102	44
866	Incoloy, 800	May 84	102	44
867	Incoloy, 825	May 84	102	44
868	High Temp. Alloy Fe-Ni-Co	Apr 93	101	28
869	LC Column Selectivity	Mar 90	109	69
871	Bronze, Phosphor (CDA 521)	Aug 79	102	40
872	Bronze, Phosphor (CDA 544)	Aug 79	102	40
874	Cupro-Nickel, 10% (CDA 706) "H-P"	Jan 78	102	40
875	Cupro-Nickel, 10% (CDA 706) "Doped"	Jan 78	102	40
879	Nickel Silver, (CDA 762)	Jun 79	102	40
880	Nickel Silver, (CDA 770)	Jun 79	102	40
882	Alloy Ni-Cu-Al	Aug 79	102	44
885	Refined Copper	Mar 91	104	48
886	Gold, Ore Refractory	Apr 93	111	81
887	Cemented Carbide (W83-Co10)	Sep 88	112	85
888	Cemented Carbide (W64-Co25-Ta5)	Sep 88	112	85
889	Cemented Carbide (W75-Co9-Ta5-Ti4)	Sep 88	112	85
890	Cast Iron, HC250 + V	Apr 82	101	37
891	Cast Iron, Ni-Hard, Type I	Apr 82	101	37
892	Cast Iron, Ni-Hard, Type IV	Apr 82	101	37
893	Stainless Steel (SAE 405)	Mar 92	101	29
895	Stainless Steel (SAE 201)	Dec 91	101	29
897	"Tracealloy" A	Aug 83	102	44
898	"Tracealloy" B	Aug 83	102	44
899	"Tracealloy" C	Aug 83	102	44
900	Antiepilepsy Drug (4) Level	Apr 79	105	56
909a	Human Serum	Oct 93	105	57
909b	Human Serum	In Prep	105	57
910	Sodium Pyruvate	May 81	105	56
911b	Cholesterol	Apr 94	105	56
912a	Urea	Dec 90	105	56
913	Uric Acid	Sep 68	105	56
914a	Creatinine	Feb 94	105	56
915a	Calcium Carbonate (Clinical)	Jan 95	105	56
916a	Bilirubin	Jun 89	105	56
917a	D-Glucose (Dextrose-Clinical)	Aug 89	105	56
918	Potassium Chloride (Clinical)	Jan 71	105	56
919a	Sodium Chloride (Clinical)	Feb 91	105	56
920	D-Mannitol	Jan 72	105	56
921	Cortisol (Hydrocortisone)	Dec 73	105	56
924a	Lithium Carbonate (Clinical)	In Prep	105	56
925	VMA (Clinical)	May 73	105	56
927b	Bovine Serum Albumin	Aug 94	105	57
928	Lead Nitrate (Clinical)	Apr 94	105	56

SRM	Descriptor	Cert. Date	Section Code	Page
929	Magnesium Gluconate	Mar 93	105	56
930e	Glass Filters, Transmittance	Jan 95	204	104
931e	Liquid Filters, Absorbance	May 93	204	104
934	Clinical Thermometer	Oct 92	203	102
935a	Potassium Dichromate, UV Absorbance	Apr 88	204	104
936a	Quinine Sulfate, Fluorescence	Dec 94	204	104
937	Iron Metal (Clinical)	Jun 78	105	56
938	4-Nitrophenol	May 81	104	56
951	Boric Acid, Assay and Isotopic	Feb 69	104	49/53
952	Boric Acid 95% enr. 10B	Feb 69	104	53
953	Neutron Density Monitor Wire	Mar 69	205	108
955a	Lead in Blood	Dec 94	105	56
956a	Electrolytes in Serum for ISE	In Prep	105	56
963a	Fission Track Glass U-1 mg/g	Feb 84	205	108
965	Glucose in Frozen Human Serum	In Prep	105	57
968b	Fat-Sol. Vit. & Chol. in Serum	In Prep	105	56
975	Chlorine (Isotopic)	Mar 65	104	53
976	Copper (Isotopic)	Nov 93	104	53
977	Bromine (Isotopic)	Mar 65	104	53
978a	Silver (Isotopic)	Sep 84	104	53
979	Chromium (Isotopic)	May 66	104	53
980	Magnesium (Isotopic)	Jan 67	104	53
981	Natural Lead (Isotopic)	Mar 91	104	53
982	Equal Atom Lead (Isotopic)	Mar 91	104	53
983	Radiogenic Lead (Isotopic)	Mar 91	104	53
984	Rubidium Assay (Isotopic)	Jul 70	104	53
985	Potassium Assay (Isotopic)	Aug 79	104	53
986	Nickel (Isotopic)	May 90	104	53
987	Strontium Assay and Isotopic	Oct 82	104	49/53
989	Rhenium Assay (Isotopic)	Feb 74	104	53
990	Silicon Assay (Isotopic)	Aug 74	104	53
991	Lead-206 Spike Assay and Isotopic	Mar 76	104	53
994	Gallium (Isotopic)	Feb 86	104	53
997	Thallium (Isotopic)	Jul 86	104	53
998	Angiotensin I (Human)	Jan 83	105	56
999a	Potassium Chloride (Assay)	In Prep	104	49
1002d	Hard Board (Surface Flammability)	Aug 89	305	130
1003b	Glass (Particle Size)	Sep 93	301	125
1004a	Glass (Particle Size)	Dec 93	301	125
1006c	Alpha-Cellulose (Smoke Density)	Oct 88	305	130
1007b	Plastic, (Smoke Density)	Apr 91	305	130
1010a	Microcopy Test Chart	Jun 90	204	107
1012	Flooring Radiant Panel	Sep 84	305	130
1017b	Glass (Particle Size)	In Prep	301	125
1018b	Glass (Particle Size)	In Prep	301	125
1019a	Glass (Particle Size)	Oct 84	301	125
1034	Unalloyed Copper	Feb 82	102	40
1035	Leaded-Tin Bronze Alloy	Feb 82	102	40
1048	Smoke Toxicity (Cup Furnace)	Nov 91	305	130
1049	Smoke Toxicity (Univ. Pitts.)	Nov 92	305	130
1051b	Barium (Metallo-Organic)	Jun 91	114	90
1052b	Vanadium (Metallo-Organic)	Apr 93	114	90
1053a	Cadmium (Metallo-Organic)	Jan 70	114	90
1057b	Tin (Metallo-Organic)	Aug 68	114	90
1059c	Lead (Metallo-Organic)	Sep 87	114	90
1060a	Lithium (Metallo-Organic)	Apr 64	114	90
1065b	Nickel (Metallo-Organic)	Nov 93	114	90
1066a	Silicon (Metallo-Organic)	Jun 91	114	90
1069b	Sodium (Metallo-Organic)	Jun 91	114	90
1070a	Strontium (Metallo-Organic)	Apr 64	114	90
1071b	Phosphorus (Metallo-Organic)	Sep 91	114	90
1073b	Zinc (Metallo-Organic)	Sep 86	114	90
1075a	Aluminum (Metallo-Organic)	Oct 67	114	90
1077a	Silver (Metallo-Organic)	Feb 68	114	90
1078b	Chromium (Metallo-Organic)	Jul 72	114	90
1079b	Iron (Metallo-Organic)	Feb 69	114	90
1080a	Copper (Metallo-Organics)	Feb 69	114	90
1083	Wear Metals (Base Oil)	Jul 91	114	91
1084a	Wear Metals	Apr 91	114	91
1085a	Wear Metals	Apr 91	114	91
1089	Steels, Set (SRMs 1095-99)	Apr 86	101	28

SRM	Descriptor	Cert. Date	Section Code	Page	SRM	Descriptor	Cert. Date	Section Code	Page
1090	Ingot Iron, Oxygen	Nov 85	101	28	1243	Waspaloy	Jan 89	102	44
1091a	Stainless Steel (AISI 431)	Nov 85	101	28	1244	Inconel 600	May 84	101	35
1093	Valve Steel, Oxygen	Nov 84	101	28	1245a	Inconel 625	May 84	101	35
1094	Maraging Steel	Nov 84	101	28	1246	Incoloy 800	May 84	101	35
1095	Steel (AISI 4340)	Apr 86	101	28	1247	Incoloy 825	May 84	101	35
1096	Steel (AISI 94B17)	Apr 86	101	28	C1248	Nickel-Copper Alloy	Dec 86	102	44
1097	Cr-V Steel (mod.)	Apr 86	101	28	1250	High Temp. Alloy Fe-Ni-Co	Jul 93	101	35
1098	Steel (High Carbon)	Apr 86	101	28	C1252	Phos. Copper 1X	Apr 86	102	42
1099	Electrolytic Iron	Apr 86	101	28	C1253	Phos Copper X	Apr 86	102	42
1104	Free-Cutting Brass	Aug 65	102	41	1254	LA Steel (Ca only)	Apr 82	101	30
1107	Naval Brass B	Nov 81	102	41	1258	Aluminum Alloy 6011	May 78	102	39
1108	Naval Brass C	Nov 81	102	41	1259	Aluminum Alloy 7075	May 78	102	39
1110	Red Brass B	Oct 81	102	41	1261a	LA Steel (AISI 4340)	May 93	101	30
1111	Red Brass C	Oct 81	102	41	1262b	LA Steel (AISI 94B17)	Oct 92	101	30
1112	Gilding Metal A (disk)	Oct 81	102	41	1263a	LA Steel Cr-V (mod.)	Feb 81	101	30
C1112	Gilding Metal A (block)	Oct 81	102	41	1264a	LA Steel, High Carbon (mod.)	Jan 88	101	30
1113	Gilding Metal B (disk)	Oct 81	102	41	1265a	Electrolytic Iron	Jun 89	101	30
C1113	Gilding Metal B (block)	Oct 81	102	41	1269	Line Pipe (AISI 1521 mod.)	Jun 81	101	30
1114	Gilding Metal C (disk)	Oct 81	102	41	1270	LA Steel, Cr-Mo (A336) (F-22)	Jun 81	101	30
C1114	Gilding Metal C (block)	Oct 81	102	41	1271	LA Steel (HSLA-100)	Oct 91	101	30
1115	Commercial Bronze A (disk)	Nov 81	102	41	1276a	Cupro-Nickel (CDA 715)	Jun 89	102	41
C1115	Commercial Bronze A (block)	Nov 81	102	41	C1285	LA Steel (A242) (mod.)	Jun 82	101	30
1116	Commercial Bronze B (disk)	Nov 81	102	41	1286	LA Steel HY 80	Mar 92	101	30
C1116	Commercial Bronze B (block)	Nov 81	102	41	C1287	Stainless Steel (AISI 310 mod.)	Jun 81	101	34
1117	Commercial Bronze C (disk)	Nov 81	102	41	C1288	Stainless Steel (A-743)	Aug 81	101	34
C1117	Commercial Bronze C (block)	Nov 81	102	41	C1289	Stainless Steel (AISI 414 mod.)	Jun 81	101	34
C1122	Beryllium-Copper (block)	Dec 81	102	41	C1290	High Alloy (HC-250 + V)	Jan 85	101	38
C1123	Beryllium-Copper (block)	Dec 81	102	41	C1291	High Alloy (Ni-Hard, Type 1)	Jan 85	101	38
1128	Ti Alloy, V-Al-Cr-Sn	Jul 91	102	45	C1292	High Alloy (Ni-Hard, Type 1V)	Jan 85	101	38
1129	Solder 63Sn-37Pb	May 89	102	43	1295	Stainless Steel (SAE 405)	Mar 92	101	34
1131	Solder 60Pb-40Sn	Oct 81	102	43	C1296	Stainless Steel 28Cr-3Mo (SAE 460)	Dec 91	101	34
1132	Bearing Metal (Pb-Sn)	Nov 94	102	43	1297	Stainless Steel Cr-Ni-Mn (SAE 201)	Dec 91	101	34
1134	LA Steel, High Silicon	Apr 70	101	30	1357	Cu & Cr Coating on Steel	Jul 91	207	117
1135	LA Steel, High Silicon	Jul 72	101	30	1358	Cu & Cr Coating on Steel	Jul 91	207	117
C1137a	White Cast Iron	Jan 84	101	38	1359	Cu & Cr Coating on Steel	Jul 91	207	117
1138a	Cast Steel (No. 1)	Jan 77	101	38	1360	Cu & Cr Coating on Steel	Jul 91	207	117
1139a	Cast Steel (No. 2)	Jan 77	101	38	1361a	Cu & Cr Coating on Steel	Jul 91	207	117
C1145a	White Cast Iron	Jan 88	101	38	1362a	Cu & Cr Coating on Steel	Jul 91	207	117
C1146a	White Cast Iron	Jan 88	101	38	1363a	Cu & Cr Coating on Steel	Jul 91	207	117
C1151a	Stainless Steel 23Cr-7Ni	Dec 92	101	34	1364a	Cu & Cr Coating on Steel	Jul 91	207	117
C1152a	Stainless Steel 18Cr-11Ni	Feb 90	101	34	1371	Gold Coating on Fe-Ni-Co Alloy	Oct 90	207	117
C1153a	Stainless Steel 17Cr-9Ni	Sep 90	101	34	1373	Gold Coating on Fe-Ni-Co Alloy	Oct 90	207	117
C1154a	Stainless Steel 19Cr-13Ni	Jun 92	101	34	1374	Gold Coating on Fe-Ni-Co Alloy	Oct 90	207	117
1155	Stainless Steel Cr-Ni-Mo (AISI 316)	Aug 69	101	34	1400	Bone Ash	Dec 92	105	56
1157	Specialty Steel, Tool (AISI M2)	Aug 73	101	34	1411	Soft Borosilicate Glass	Aug 85	112	86
1158	Specialty Steel, High Nickel (Ni36)	Dec 77	101	34	1412	Multicomponent Glass	Aug 85	112	86
1159	Elec/Mag Ni-Fe	Aug 81	102	44	1413	Glass Sand (High Alumina)	Aug 85	111/112	83/86
1160	Elec/Mag Ni-Mo-Fe	Aug 81	102	44	1414	Lead-Silica (Resistivity)	Jul 91	208	119
1171	Stainless Steel Cr-Ni-Ti (AISI 321)	May 93	101	34	1416	Glass Al-Silicate (Glass Liquidus)	May 94	208	120
1172	Stainless Steel Cr-Ni-Nb (AISI 348)	Jul 71	101	34	1449	Fumed Silica Board	Jan 89	203	103
1173	Ni-Cr-Mo-V Steel	Jun 89	101	38	1450b	Fibrous Glass Board	May 85	203	103
C1173	Cast Steel 3	Jan 89	101	38	1452	Fibrous Glass Blanket	Apr 86	203	103
1216	Carbon Modified Silicon	Nov 87	106	62	1457	Superconducting Nb-Ti Wire	Jun 84	206	115
1218	LA Steel, High Silicon	Nov 84	101	30	1459	Fumed Silica Board	Jan 89	203	103
1219	Stainless Steel Cr-Ni (AISI 431)	Sep 85	101	34	1461	Stainless Steel (Therm./Elec. Resist.)	May 84	203/206	103/114
C1221	LA Carbon (AISI 1211)	Apr 93	101	30	1462	Stainless Steel (Therm./Elect. Resist.)	May 84	203/206	103/114
1222	LA Steel, Cr-Ni-Mo (AISI 8640)	Sep 90	101	30	1473	Polyethylene Resin	Oct 91	202	97
1223	Chromium Steel	May 93	101	34	1474	Polyethylene Resin	Apr 90	202	97
1224	LA Steel, Carbon (AISI 1078)	Feb 81	101	30	1475a	Polyethylene, Linear	Dec 93	202	97
1225	LA Steel (AISI 4130)	Mar 83	101	30	1478	Polystyrene, Narrow Mol. Wt.	Jul 92	202	97
1226	LA Steel	Dec 82	101	30	1479	Polystyrene, Narrow Mol. Wt.	Mar 92	202	97
1227	LA Steel, Basic Open Hearth, 1% C	Mar 83	101	30	1480	Polyurethane	Aug 92	202	97
1228	LA Steel, 0.1% C	Jun 93	101	30	1482	Polyethylene, Linear	Oct 76	202	97
1230	High Temp. Alloy, A286	Jun 87	101	35	1483	Polyethylene, Linear	Mar 76	202	97
1233	Specialty Steel, Valve Steel	Mar 92	101	34	1484a	Polyethylene, Linear	Oct 92	202	97
1235	Zirconium B for Hf	Nov 80	102	46	1486	Bone Meal	Dec 92	105	56
1242	High Temp. Alloy L-605	Nov 91	102	39	1487	Poly (methylmethacrylate)	Jun 89	202	97

SRM	Descriptor	Cert. Date	Section Code	Page	SRM	Descriptor	Cert. Date	Section Code	Page
1488	Poly (methylmethacrylate)	Feb 88	202	97	1655	KCl Solution Calorimetry	Mar 81	203	99
1489	Poly (methylmethacrylate)	Mar 86	202	97	1656	Thianthrene Combustion Calorimetry	Jan 85	203	99
1491	Arom. Hydro/Hexane Toluene	Aug 89	109	69	1657	Synthetic Refuse-Derived Fuel	May 93	203	99
1492	Chlor. Pesticides/Hexane	Apr 92	109	69	1658a	CH4/Air, 1 μ mol/mol	Jun 93	107	64
1493	PCB Congeners	Feb 95	109	69	1659a	CH4/Air, 10 μ mol/mol	In Prep	107	64
1496	Polyethylene Gas Pipe Resin	Sep 88	202	97	1660a	CH4-C3H8/Air, 1 μ mol/mol	In Prep	107	64
1497	Polyethylene Gas Pipe Resin	Jul 87	202	97	1661a	SO2/N2, 500 μ mol/mol	In Prep	107	65
1507b	THC-COOH in Urine	Nov 94	105	58	1662a	SO2/N2, 1000 μ mol/mol	Aug 93	107	65
1508	Cocaine & Metab. in Urine	Oct 90	105	58	1663a	SO2/N2, 1500 μ mol/mol	Jul 93	107	65
1511	Multi Drugs of Abuse in Urine	Sep 94	105	58	1664a	SO2/N2, 2500 μ mol/mol	In Prep	107	65
1514	Thermal Analysis Purity Set (DSC)	Jul 84	203	100	1665b	C3H8/Air, 3 μ mol/mol	In Prep	107	64
1515	Apple Leaves	Jan 93	110	77	1666b	C3H8/Air, 10 μ mol/mol	In Prep	107	64
1521	Silicon Resistivity 0.1-10	Oct 91	206	114	1667b	C3H8/Air, 50 μ mol/mol	In Prep	107	64
1523	Silicon Resistivity 0.01-1	Oct 91	206	114	1668b	C3H8/Air, 100 μ mol/mol	Jun 93	107	64
1543	GC/MS and LS System Performance	Aug 84	109	69	1669b	C3H8/Air, 500 μ mol/mol	In Prep	107	64
1544	Diet Composite	In Prep	110	76	1670a	CO2/Air, 300 μ mol/mol	In Prep	107	64
1547	Peach Leaves	Jan 92	110	77	1671a	CO2/Air, 340 μ mol/mol	In Prep	107	64
1548	Total Diet	Nov 91	110	76	1672a	CO2/Air, 350 μ mol/mol	In Prep	107	64
1548a	Typical Diet	In Prep	110	76	1674b	CO2/N2, mol 7%	Aug 93	107	63
1549	Non-Fat Milk Powder	Jul 85	110	75	1675b	CO2/N2, mol 14%	Aug 93	107	63
1563	Coconut Oil	Jul 87	110	76	1677c	CO/N2, 10 μ mol/mol	Mar 94	107	64
1566a	Oyster Tissue	Oct 89	110	75	1678c	CO/N2, 50 μ mol/mol	In Prep	107	64
1567a	Wheat Flour	Sep 88	110	75	1679c	CO/N2, 100 μ mol/mol	In Prep	107	64
1568a	Rice Flour	Jan 88	110	75	1680b	CO/N2, 500 μ mol/mol	In Prep	107	64
1570a	Trace Elements in Spinach Leaves	Oct 94	110	77	1681b	CO/N2, 1000 μ mol/mol	In Prep	107	64
1573a	Tomato Leaves	Oct 93	110	77	1683b	NO/N2, 50 μ mol/mol	Mar 94	107	64
1575	Pine Needles	Feb 93	110	77	1684b	NO/N2, 100 μ mol/mol	Oct 94	107	64
1577b	Bovine Liver	Aug 91	110	75	1685b	NO/N2, 250 μ mol/mol	In Prep	107	64
1579a	Powdered Lead Base Paint	Feb 92	105	60	1686b	NO/N2, 500 μ mol/mol	In Prep	107	64
1580	Shale Oil	Nov 80	109	69	1687b	NO/N2, 1000 μ mol/mol	In Prep	107	64
1581	PCBs in Oil	Jun 90	109	69	1690	Polystyrene (Particle Size)	Dec 82	301	125
1582	Petroleum Crude Oil	Jan 84	109	69	1691	Polystyrene (Particle Size)	May 84	301	125
1583	Chlor. Pesticide in Isooctane	Feb 85	109	69	1692	Polystyrene (Particle Size)	May 91	301	125
1584	Phenols in Methanol	Apr 84	109	69	1693a	SO2/N2, 50 μ mol/mol	In Prep	107	65
1585	Chlorinated Biphenyls	Jan 86	109	69	1694a	SO2/N2, 100 μ mol/mol	In Prep	107	65
1586	Isotope Label Pollutants	Oct 84	109	69	1696a	SO2/N2, 3500 μ mol/mol	Jul 93	107	65
1587	Nitro PAH in Methanol	Jun 85	109	69	1700a	CO2/N2, 10 mol (Blood Gas) %	Aug 88	107	63
1588	Organics in Cod Liver Oil	Jan 89	109	69	1701a	CO2-5%, O2-12 mol (Blood Gas) %/N2	Aug 88	107	63
1589	PCBs (Aroclor 1260) in Human Serum	Nov 85	109	69	1702a	CO2-5%, O2-20 mol (Blood Gas) %/N2	Aug 88	107	63
1595	Tripalmitin	Jul 83	105	56	1703a	CO2-10%, O2-7 mol (Blood Gas) %/N2	Aug 88	107	63
1596	Nitropyrenes in Methylene Chloride	Jul 87	109	69	1710	Aluminum Alloy 3004	Jun 93	102	39
1597	Complex PAH Mix	May 92	109	69	1711	Aluminum Alloy 3004	Jun 93	102	39
1598	Inorg. Const. in Bovine Serum	Jan 90	105	56	1712	Aluminum Alloy 3004	Jun 93	102	39
1599	2 Anticonvulsant Drugs	Aug 82	105	56	1713	Aluminum Alloy 5182	Jun 93	102	39
1614	Dioxin in Isooctane	Jul 85	109	69	1714	Aluminum Alloy 5182	Jun 93	102	39
1616a	Sulfur in Kerosene	In Prep	108	67	1715	Aluminum Alloy 5182	Jun 93	102	39
1617a	Sulfur in Kerosene	In Prep	108	67	1744	Aluminum Freezing Point	Nov 94	203	101
1618	Vanadium & Nickel in Fuel Oil	May 85	108	66	1746	Silver (Freezing Point)	Jul 93	203	101
1619a	Sulfur in Residual Fuel Oil	Apr 91	108	67	1754	Steel (AISI 4320)	Feb 89	101	28
1620b	Sulfur in Residual Fuel Oil	Jul 90	108	67	1761	LA Steel	Apr 92	101	30
1621d	Sulfur in Residual Fuel Oil	Mar 91	108	67	1762	LA Steel	Apr 92	101	30
1622d	Sulfur in Residual Fuel Oil	Mar 94	108	67	1763	LA Steel	Apr 92	101	30
1623b	Sulfur in Residual Fuel Oil	Jul 90	108	67	1764	LA Steel	Feb 93	101	30
1624b	Sulfur in Distillate Fuel Oil	Mar 94	108	67	1765	LA Steel	Feb 93	101	30
1625	SO2 Permeation Tube-10 cm	In Prep	107	65	1766	LA Steel	Feb 93	101	30
1626	SO2 Permeation Tube-5 cm	In Prep	107	65	1767	LA Steel	Jun 93	101	30
1627	SO2 Permeation Tube-2 cm	Aug 92	107	65	1768	High-Purity Iron	Dec 91	101	30
1629a	NO2 Permeation Device 1cm	In Prep	107	65	1776	Naval Brass WK1	In Prep	102	43
1632b	Trace Elements in Coal (Bituminous)	Oct 93	108	68	1777	Naval Brass WK2	In Prep	102	43
1633b	Trace Elements in Coal Fly Ash	Jun 93	108	68	1778	Naval Brass WK3	In Prep	102	43
1634c	Trace Elements in Fuel Oil	In Prep	108	68	1779	Naval Brass WK4	In Prep	102	43
1635	Trace Elements in Coal (Subbituminous)	Aug 79	108	68	1780	Naval Brass WK5	In Prep	102	43
1639	Halocarbons (in methanol)	Apr 83	109	69	1800	Organic Compounds/N2	Dec 93	107	65
1640	Natural Water	In Prep	106	61	1804a	Tox. Organic Compounds/N2	Nov 92	107	65
1641c	Mercury in Water	Jun 93	106	61	1810a	Linerboard	Jun 90	309	131
1643d	Trace Elements in Water	In Prep	106	61	1811	Aromatic Organics/N2	Apr 93	107	63
1646a	Estuarine Sediment	Jan 95	106/111	61/84	1812	Aromatic Organics/N2	Feb 93	107	63
1647c	Priority Pollutant PAHs	Apr 94	109	69	1815a	n-Heptane (Fuel Rating)	Mar 85	108	67
1648	Urban Particulate Matter	Aug 91	106	62	1816a	Isooctane (Fuel Rating)	Mar 85	108	67
1649	Urban Dust/Organics	Jan 92	109	69	1817c	Catalyst Package IIID	Jun 92	114	91
1650	Diesel Particulate Matter	Dec 91	109	69	1818a	Chlorine in Lub. Base Oil	Apr 94	114	90

SRM	Descriptor	Cert. Date	Section Code	Page	SRM	Descriptor	Cert. Date	Section Code	Page
1819a	Sulfur in Lub. Base Oil	Apr 94	114	90	1969	Rubidium (Fixed Point)	Mar 91	203	101
1820	Borosilicate Glass (Refractive Index)	Sep 74	209	122	1970	Succinonitrile (Fixed Point)	Apr 91	203	101
1822	Soda-Lime Glass (Refractive Index)	Nov 84	209	122	1971	Indium	Aug 90	203	101
1826	Soda-Lime Glass (Density)	Aug 90	209	122	1972	1,3-Dioxolan-2-one (Fixed Point)	May 94	203	101
1827	Lead Silica Glass (Density)	Aug 90	209	122	1973	n-Docosane (Fixed Point)	May 93	203	101
1828a	Ethanol-Water Soln.	In Prep	105	57	1974a	Organics in Mussel Tissue	In Prep	109	69
1829	Alcohols in Ref. Fuels	Mar 86	108	66	1976	Instrument Intensity, Alumina (XRD)	Nov 91	209	121
1830	Soda Lime Float (Glass)	Sep 91	112	86	1978	Zirconium Oxide (Particle Size)	Oct 93	301	125
1831	Soda Lime Sheet (Glass)	Sep 91	112	86	1980	Electrophoretic Mobility (Positive)	Mar 94	301	126
1832	Thin Glass Film (XRF)	May 84	106	61	1981	Electrophoretic Mobility (Negative)	In Prep	301	126
1833	Thin Glass Film (XRF)	May 84	106	61	2003	First Surface Aluminum on Glass	In Prep	204	107
1834	Fused Ore (Glass)	Jul 90	112	86	2011	First Surface, Gold on Glass	May 92	204	107
1835	Borate Ore	Sep 87	111	81	2015	Opal Glass (Reflectance)	May 82	204	107
1836	Nitrogen in Lub. Base Oil	Dec 89	114	90	2023	Second Surface, Aluminum on Quartz	Sep 92	204	107
1837	Methanol, Butanol (Fossil Fuel)	Mar 86	108	66	2026	First Surface, Black Glass	Oct 92	204	107
1838	Ethanol (Fossil Fuel)	Mar 86	108	66	2030a	Glass Filters, Transmittance	Oct 93	204	105
1839	Methanol (Fossil Fuel)	Mar 86	108	66	2031	Metal-on-Quartz Filters, Transmittance	In Prep	204	105
1842	X-Ray Stage Calib., X and Y Dimen.	Nov 93	209	121	2032	Potassium Iodide, Stray Light	Oct 79	204	106
1843	X-Ray Stage Calib., Z Dimen.	Nov 93	209	121	2034	Holmium Oxide Wavelength	In Prep	204	106
1845	Cholesterol in Egg Powder	Apr 94	110	76	2063a	Mineral Glass (Thin Film)	Feb 93	103	47
1846	Infant Formula (milk-based)	In Prep	110	76	2069b	SEM Performance	May 91	207	116
1850	Penetrant Test Block	Dec 80	303	128	2071a	Sinusoidal Roughness	In Prep	302	127
1851	NDE Penetrant Test Block	Apr 84	303	128	2072	Sinusoidal Roughness	Dec 89	302	127
1853	Magnetic Particle Test Ring	Apr 92	303	128	2073a	Sinusoidal Roughness	In Prep	302	127
1857	Tool Steel (Abrasive Wear)	Mar 83	302	127	2074	Sinusoidal Roughness	Jun 92	302	127
1866a	Common Commercial Asbestos	Jun 91	105	60	2075	Sinusoidal Roughness	Jan 94	302	127
1867	Uncommon Commercial Asbestos	Aug 93	105	60	2083	Socketed Ball Bar	Aug 85	309	131
1868	Asbestos in Building Materials	In Prep	105	60	2084	CMM Probe Performance	Apr 94	309	131
1872	Synthetic Glass	May 84	103	47	2085	CMM Probe (25-mm sphere)	In Prep	309	131
1873	Synthetic Glass	May 84	103	47	2090	SEM Magnification	In Prep	207	116
1876b	Chrysotile Asbestos	Jan 92	105	60	2092	Low-Energy Charpy	Nov 94	309	131
1878a	Respirable α -Quartz	In Prep	105	60	2096	High-Energy Charpy	Nov 94	309	131
1879	Respirable Cristobalite	Jan 88	105	60	2098	Super High-Energy Charpy	Nov 94	309	131
1879a	Respirable Cristobalite	In Prep	105	60	2108	Chromium (III) Speciation	Dec 92	104	53
1880	Portland Cement, Black	Jan 93	113	88	2109	Chromium (VI) Speciation	Jul 92	104	53
1881	Portland Cement, White	Jan 89	113	88	2135c	Ni-Cr Depth profile	In Prep	207	116
1882	Portland Cement, Orange	Jul 90	113	88	2136	Cr/CrO ₂ Depth Profile	Mar 91	207	116
1883	Portland Cement, Silver	Jul 90	113	88	2137	B Implant in Si Depth Profile	Apr 93	207	116
1884	Portland Cement, Ivory	Sep 89	113	88	2141	Urea	Aug 70	104	49
1885	Portland Cement, Turquoise	Sep 89	113	88	2142	0-Bromobenzoic Acid	Sep 70	104	49
1886	Portland Cement, Cranberry	Sep 89	113	88	2143	p-Fluorobenzoic Acid	Jan 82	104	49
1887	Portland Cement, Brown	Sep 89	113	88	2144	m-Chlorobenzoic Acid	Apr 73	104	49
1888	Portland Cement, Purple	Sep 89	113	88	2151	Nicotinic Acid (Comb. Calorimetry)	Jan 85	203	99
1889	Portland Cement, Gray	Sep 89	113	88	2152	Urea (Comb. Calorimetry)	Jan 85	203	99
1893	Microhardness, Cu-Knoop	Mar 95	302	127	2159	LA Steel, Carbon & Sulfur only	Mar 90	101	27
1894	Microhardness, Cu-Vickers	Nov 94	302	127	2160	LA Steel, Carbon & Sulfur only	Mar 90	101	27
1895	Microhardness, Ni-Knoop	Mar 95	302	127	2165	LA Steel, E	Jun 89	101	27
1896	Microhardness, Ni-Vickers	Mar 95	302	127	2166	LA Steel	Jun 89	101	27
1905	Microhardness, Ni-Knoop	Mar 92	302	127	2167	LA Steel, G	Jun 89	101	27
1906	Microhardness, Ni-Knoop	Nov 94	302	127	2168	High-Purity Iron	Dec 91	101	27
1907	Microhardness, Ni-Knoop	Mar 95	302	127	2171	LA Steel, (HSLA 100)	Oct 91	101	26
1920	IR Reflectance	Jul 86	204	107	2181	HEPES Free Acid	Mar 92	201	95
1921	IR Transmission Wavelength	Jan 94	204	104	2182	HEPES ate	Mar 92	201	95
1923	Poly(ethylene oxide)	Jun 94	202	97	2183	MOPSO Free Acid	Mar 92	201	95
1924	Poly(ethylene oxide)	Jun 94	202	97	2184	MOPSO Bte	Mar 92	201	95
1930	Glass Filters, Transmittance	Aug 94	204	105	2185	Pot. Hydrogen Phthalate	Nov 84	201	95
1931	Fluorescence Spectra	Aug 89	204	105	21861	Pot. Dihydro. Phosphate	May 68	201	95
1939	PCBs in River Sediment A	Oct 90	109	69	218611	Disod. Hydro. Phosphate	May 68	201	95
1941a	Organics in Marine Sediment	Mar 94	109	69	2191a	Sodium Bicarbonate	Feb 94	201	95
1945	Organics in Whale Blubber	Jun 94	109	69	2192a	Sodium Carbonate	Feb 94	201	95
1951a	Cholesterol in Human Serum	In Prep	105	56	2193	Calcium Carbonate	Oct 91	201	95
1952a	Cholesterol in Human Serum	Jan 90	105	56	2201	Sodium Chloride (Ion-Selective)	May 93	201	96
1960	Polystyrene (Particle Size)	Apr 85	301	125	2202	Potassium Chloride (Ion-Selective)	Mar 84	201	96
1961	Polystyrene (Particle Size)	Jan 87	301	125	2203	Potassium Fluoride (Ion-Selective)	May 73	201	96
1963	Polystyrene (Particle Size)	Nov 93	301	125	2220	Tin (Dif. Scan. Calor.)	May 89	203	100
1965	Polystyrene (on Slide)(Particle Size)	Jan 87	301	125	2221b	Zinc (Dif. Scan. Calor.)	In Prep	203	100
1967	Pt Thermocouple Wire	Jul 90	203	102	2222	Biphenyl (Dif. Scan. Calor.)	Jun 89	203	100
1968	Gallium (Fixed Point)	Mar 91	203	101	2225	Mercury (Dif. Scan. Calor.)	Mar 89	203	100

SRM	Descriptor	Cert. Date	Section Code	Page	SRM	Descriptor	Cert. Date	Section Code	Page
2260	Aromatic Hydrocarbons in Toluene	Jun 91	109	69	2624a	CO2/N2, 3.0 mol %	In Prep	107	63
2261	Chlorinated Pesticides in Hexane	Jan 92	109	69	2625a	CO2/N2, 3.5 mol %	Aug 94	107	63
2262	Chlorinated Biphenyls in Isooctane	In Prep	109	69	2626a	CO2/N2, 4.0 mol %	In Prep	107	63
2286	Ethanol in Gasoline	Feb 95	108	66	2627a	NO/N2, 5 µmol/mol	In Prep	107	64
2287	Ethanol in Gasoline	Jan 95	108	66	2628a	NO/N2, 10 µmol/mol	In Prep	107	64
2288	t-Amyl Methyl Ether in Gas.	Jan 95	108	66	2629a	NO/N2, 20 µmol/mol	In Prep	107	64
2289	t-Amyl Methyl Ether in Gas.	Jan 95	108	66	2630	NO/N2, 1500 µmol/mol	In Prep	107	64
2290	Ethyl t-Butyl Ether in Gas.	Jan 95	108	66	2631a	NO/N2, 3,000 µmol/mol	In Prep	107	64
2291	Ethyl t-Butyl Ether in Gas.	Jan 95	108	66	2632a	CO2/N2, 300 µmol/mol	Sep 90	107	63
2292	Methyl t-Butyl Ether in Gas.	Jan 95	108	66	2635a	CO/N2, 25 µmol/mol	In Prep	107	64
2293	Methyl t-Butyl Ether in Gas.	Feb 95	108	66	2636a	CO/N2, 250 µmol/mol	In Prep	107	64
2321	Sn-Pb Alloy Coating	Jun 91	207	117	2637a	CO/N2, 2500 µmol/mol	In Prep	107	64
2350	Nickel Step Test	Aug 85	302	127	2638a	CO/N2, 5000 µmol/mol	In Prep	107	64
2381	Morphine and Codeine in Urine	Jul 93	105	58	2639a	CO/N2, 1 mol %	May 92	107	64
2382	Morphine Glucuronide in Urine	Jul 93	105	58	2640a	CO/N2, 2 mol %	Nov 88	107	64
2383	Foods/Baby Foods	In Prep	110	76	2641a	CO/N2, 4 mol %	Nov 88	107	64
2389	Amino Acids in Hydrochloric Acid	Dec 93	105	56	2642a	CO/N2, 8 mol %	Sep 93	107	64
2390	DNA Profiling	Aug 92	105	59	2643a	C3H8/N2, 100 µmol/mol	Sep 90	107	65
2391	PCR-Based DNA Profiling	In Prep	105	59	2644a	C3H8/N2, 250 µmol/mol	Sep 90	107	65
2392	DNA Mitochondrial Sequencing	In Prep	105	59	2645a	C3H8/N2, 500 µmol/mol	In Prep	107	65
C2400	HA Steel ACI (17/4 PH)	Feb 86	101	35	2646a	C3H8/N2, 1000 µmol/mol	In Prep	107	65
C2401	HA Steel (ACI-C-4M-Cu)	Feb 86	101	35	2647a	C3H8/N2, 2500 µmol/mol	In Prep	107	65
C2402	Hastelloy C	Feb 86	101	35	2648a	C3H8/N2 5000 µmol/mol	Oct 93	107	65
C2415	Battery Lead	Mar 91	102	43	2649a	C3H8/N2, 1 mol %	In Prep	107	65
C2416	Bullet Lead	Feb 88	102	43	2650	C3H8/N2, 2 mol %	Jan 93	107	65
C2417	Lead-Base Alloy	Feb 87	102	43	2651	C3H8/N2 & O2, 0.01/5 mol %	Apr 93	107	65
C2418	High-Purity Lead	Feb 87	102	43	2652	C3H8/N2 & O2, 0.01/10 mol %	Apr 93	107	65
C2423	Ductile Iron A	Nov 85	101	38	2656	NOx/Air, 2500 µmol/mol	Apr 93	107	64
C2423a	Ductile Iron B	Nov 85	101	38	2657a	O2/N2, 2 mol %	Jun 93	107	64
C2424a	Ductile Iron D	Jul 85	101	38	2658a	O2/N2, 10 mol %	Jun 93	107	64
C2424	Ductile Iron C	Jul 85	101	38	2659a	O2/N2, 21 mol %	Jun 93	107	64
2430	Scheelite Ore	Jan 87	111	79	2660	NOx/Air, 100 µmol/mol	Jul 93	107	64
2431	Titanium Base Alloy	Aug 93	102	45	2670	Toxic Metals in Urine	Aug 94	105	57
2432	Titanium Base Alloy	Aug 93	102	45	2671a	Fluorine in Urine	Dec 82	105	57
2520	Optical Fiber Diameter	Jan 93	207	116	2672a	Mercury in Urine	May 83	105	57
2526	111P-Type Si. Sprd. Resist.	Aug 83	206	114	2676d	Metals on Filter Media	Aug 92	105	59
2527	111N-Type Si. Sprd. Resist.	Aug 83	206	114	2677a	Be and As on Filter Media	Feb 94	105	59
2528	100P-Type Si. Sprd. Resist.	Jan 84	206	114	2678	Membrane Blank Filter	May 88	105	59
2529	100N-Type Si. Sprd. Resist.	May 84	206	114	2679a	Quartz on Filter Media	May 84	105	59
2531	Si/SiO2 Thickness-50 nm	Jul 92	207	118	2681	Ashless Blank Filter	May 88	105	59
2532	Si/SiO2 Thickness-100 nm	Jul 92	207	118	2682a	Sulfur in Coal, 0.5%, (also Heat of Comb.)	May 94	108	67
2533	Si/SiO2 Thickness-200 nm	Jul 92	207	118	2683a	Sulfur in Coal, 2%, (also Heat of Comb.)	Nov 92	108	67
2534	Si/SiO2 Thickness-25 nm	Jul 92	207	118	2684a	Sulfur in Coal, 3%, (also Heat of Comb.)	Nov 92	108	67
2535	Si/SiO2 Thickness-14 nm	Sep 94	207	118	2685a	Sulfur in Coal, 5%, (also Heat of Comb.)	May 94	108	67
2536	Si/SiO2 Thickness-76 mm	Sep 94	207	118	2689	Coal Fly Ash	Dec 93	108	68
2541	Silicon Resistivity	In Prep	206	114	2690	Coal Fly Ash	Dec 93	108	68
2542	Silicon Resistivity	In Prep	206	114	2691	Coal Fly Ash	Dec 93	108	68
2543	Silicon Resistivity	In Prep	206	114	2692a	Sulfur in Coal, 1%	Sep 94	108	67
2544	Silicon Resistivity	In Prep	206	114	2694a	Simulated Rainwater	Feb 95	106	61
2545	Silicon Resistivity	In Prep	206	114	2695	Fluoride in Vegetation	Aug 91	110	77
2546	Silicon Resistivity	In Prep	206	114	2704	Buffalo River Sediment	Jul 90	106/111	61/84
2547	Silicon Resistivity	In Prep	206	114	2709	San Joaquin Soil	Aug 93	111	84
2551	Oxygen in Silicon	Mar 94	207	118	2710	Montana I Soil	Aug 93	111	84
2556	Recycled Pellet (Autocatalyst)	Aug 93	106	62	2711	Montana II Soil	Aug 93	111	84
2557	Recycled Monolith (Autocatalyst)	Aug 93	106	62	2712	Lead in Ref. Fuel	Sep 88	108	66
2567	Catalyst Package IIIE	In Prep	114	91	2713	Lead in Ref. Fuel	Sep 88	108	66
2579	Lead Paint Film	Mar 93	105	60	2714	Lead in Ref. Fuel	Sep 88	108	66
2580	Powdered Paint	In Prep	105	60	2715	Lead in Ref. Fuel	Sep 88	108	66
2581	Powdered Paint	In Prep	105	60	2717	Sulfur in Residual Fuel Oil	Oct 90	108	67
2582	Powdered Paint, (Low Lead)	Jun 94	105	60	2724	Sulfur in Diesel Fuel Oil, 0.04%	Jul 93	108	67
2607	CO2/N2O/Air, 340/0.3 µmol/mol	Nov 88	107	63	2727	IM Gases, 3 Components	Apr 92	107	64
2609	CO2/N2O/Air, 380/0.33 µmol/mol	Nov 88	107	63	2728	IM Gases, 3 Components	Apr 92	107	64
2610	CO2/N2O/Air, 380/0.33 µmol/mol	Nov 88	107	63	2730	H2S/N2, 5 µmol/mol	In Prep	107	65
2612a	CO/Air, 10 µmol/mol	Apr 91	107	63	2731	H2S/N2, 20 µmol/mol	In Prep	107	65
2613a	CO/Air, 20 µmol/mol	Oct 94	107	63	2735	NO/N2, 800 µmol/mol	In Prep	107	64
2614a	CO/Air, 45 µmol/mol	In Prep	107	63	2736	NO/N2, 2000 µmol/mol	Sep 90	107	64
2619a	CO2/N2, 0.5 mol %	Jun 92	107	63	2740	CO/N2, 10 mol %	Sep 90	107	64
2620a	CO2/N2, 1.0 mol %	Jun 92	107	63	2741	CO/N2, 13 mol %	Sep 90	107	64
2621a	CO2/N2, 1.5 mol %	In Prep	107	63	2745	CO2/N2, 16 mole Percent	In Prep	107	64
2622a	CO2/N2, 2.0 mol %	In Prep	107	63	2750	CH4/N2, 50 µmol/mol	Sep 90	107	64
2623a	CO2/N2, 2.5 mol %	Jun 92	107	63	2751	CH4/N2, 100 µmol/mol	In Prep	107	64

SRM	Descriptor	Cert. Date	Section Code	Page	SRM/RM	Descriptor	Cert. Date	Section Code	Page
2764	C3H8/Air, 0.25 μ mol/mol	In Prep	107	64	3166a	Ytterbium Spectro Soln.	Jan 94	104	51
2775	Foundry Coke	In Prep	108	67	3167a	Yttrium Spectro Soln.	Jul 93	104	51
2776	Foundry Coke	In Prep	108	67	3168a	Zinc Spectro Soln.	Dec 94	104	51
2798	Microhardness, Ni Vickers	Aug 93	302	127	3169	Zirconium Spectro Soln.	Jan 95	104	51
2830	Microhardness, Ceramic-Knoop	In Prep	302	127	3171a	Multielement Mix A1 Soln.	Nov 94	104	51
2831	Microhardness, Ceramic-Vickers	In Prep	302	127	3172a	Multielement Mix B1 Soln.	Jan 95	104	52
3087	Metals on Filter Media	Jun 90	105	59	3179	Multielement Mixes I, II, III	Jul 94	104	52
3101a	Aluminum Spectro Soln.	Feb 94	104	50	3181	Sulfate Anion Soln.	Jan 95	104	53
3102a	Antimony Spectro Soln.	Nov 94	104	50	3182	Chloride Anion Soln.	Aug 94	104	53
3103a	Arsenic Spectro Soln.	Jul 94	104	50	3183	Fluoride Anion Soln.	Dec 94	104	53
3104a	Barium Spectro Soln.	Nov 94	104	50	3184	Bromide Anion Soln.	Sep 94	104	53
3105a	Beryllium Spectro Soln.	Mar 95	104	50	3185	Nitrate Anion Soln.	Aug 94	104	53
3106	Bismuth Spectro Soln.	Mar 95	104	50	3186	Phosphate Anion Soln.	Nov 93	104	53
3107	Boron Spectro Soln.	Aug 94	104	50	3190	Electro. Conductivity (25 μ S/cm)	Feb 95	201	96
3108	Cadmium Spectro Soln.	Sep 93	104	50	3191	Electro. Conductivity (100 μ S/cm)	Jul 94	201	96
3109a	Calcium Spectro Soln.	Jul 94	104	50	3192	Electro. Conductivity (500 μ S/cm)	Jul 94	201	96
3110	Cerium Spectro Soln.	Feb 95	104	50	3193	Electro. Conductivity (1000 μ S/cm)	Feb 95	201	96
3111a	Cesium Spectro Soln.	May 93	104	50	3194	Electro. Conductivity (10,000 μ S/cm)	Mar 94	201	96
3112a	Chromium Spectro Soln.	Apr 94	104	50	3195	Electro. Conductivity (100,000 μ S/cm)	Jun 93	201	96
3113	Cobalt Spectro Soln.	Mar 95	104	50	3196	Electro. Conductivity (20,000 μ S/cm)	Jan 93	201	96
3114	Copper Spectro Soln.	Mar 94	104	50	3198	Electro. Conductivity (5 μ S/cm)	In Prep	201	96
3115a	Dysprosium Spectro Soln.	Apr 92	104	50	3199	Electro. Conductivity (15 μ S/cm)	In Prep	201	96
3116a	Erbium Spectro Soln.	Dec 93	104	50	3201	Sec. Std. Mag. Tape	Mar 94	304	129
3117a	Europium Spectro Soln.	Jan 94	104	50	3202	Sec. Std. Mag. Tape	Mar 94	304	129
3118a	Gadolinium Spectro Soln.	Jan 95	104	50	3203	Sec. Std. Mag. Tape	Mar 94	304	129
3119a	Gallium Spectro Soln.	Oct 93	104	50	3204	Sec. Std. Mag. Tape	Mar 94	304	129
3120	Germanium Spectro Soln.	Nov 94	104	50	3217	Sec. Std. Mag. Tape High Density	Jul 87	304	129
3121	Gold Spectro Soln.	Sep 93	104	50	4200B	Cesium/Barium-137m	Dec 79	205	112
3122	Hafnium Spectro Soln.	Feb 91	104	50	4201B	Niobium-94	Jun 70	205	112
3123a	Holmium Spectro Soln.	Jan 94	104	50	4203D	Cobalt-60	Feb 84	205	112
3124a	Indium Spectro Soln.	Jan 94	104	50	4207B	Cesium-137/Barium-137m	Mar 87	205	112
3126a	Iron Spectro Soln.	Nov 94	104	50	4222C	Carbon-14 (as hexadene)	Jan 91	205	109
3127a	Lanthanum Spectro Soln.	Jan 95	104	50	4226C	Nickel-63	In Prep	205	109
3128	Lead Spectro Soln.	Mar 94	104	50	4233C	Cesium-137 Burn-up Std. (Soln.)	Dec 89	205	109
3129a	Lithium Spectro Soln.	Mar 94	104	50	4234A	Strontium-90	Apr 95	205	109
3130a	Lutetium Spectro Soln.	Jan 94	104	50	4235	Beryllium-10/Beryllium-9	Nov 86	205	111
3131a	Magnesium Spectro Soln.	Apr 94	104	50	4241B	Barium-133	Apr 82	205	112
3132	Manganese Spectro Soln.	Jun 94	104	50	4251C	Barium-133 Soln.	Dec 81	205	109
3133	Mercury Spectro Soln.	Mar 94	104	50	4275C	Mixed Radionuclide	Sep 88	205	112
3134	Molybdenum Spectro Soln.	Dec 94	104	50	4276C	Mixed Radionuclide Soln.	Sep 88	205	109
3135a	Neodymium Spectro Soln.	Sep 94	104	50	4288A	Technetium-99 Soln.	Nov 82	205	109
3136	Nickel Spectro Soln.	Sep 94	104	50	4320	Curium-244 Soln.	Mar 89	205	109
3137	Niobium Spectro Soln.	Aug 94	104	50	4321B	Natural Uranium Soln.	Nov 86	205	109
3138	Palladium Spectro Soln.	Nov 94	104	50	4322B	Americium-241 Soln.	Oct 91	205	109
3139a	Phosphorus Spectro Soln.	May 94	104	50	4323A	Plutonium-238 Soln.	Nov 86	205	109
3140	Platinum Spectro Soln.	May 94	104	50	4324A	Uranium-232	In Prep	205	109
3141a	Potassium Spectro Soln.	Nov 94	104	50	4326	Polonium-209	Jan 95	205	109
3142a	Praseodymium Spectro Soln.	Sep 94	104	50	4328A	Thorium-229 Soln.	May 85	205	109
3143	Rhenium Spectro Soln.	Oct 93	104	50	4329	Curium-243 Soln.	Mar 85	205	109
3144	Rhodium Spectro Soln.	Jan 95	104	50	4332D	Americium-243 Soln.	Aug 90	205	109
3145a	Rubidium Spectro Soln.	Dec 93	104	50	4334E	Plutonium-242 Soln.	Jan 93	205	109
3147a	Samarium Spectro Soln.	Dec 93	104	51	4338	Plutonium-240 Soln.	Sep 80	205	109
3148a	Scandium Spectro Soln.	Aug 94	104	51	4339A	Radium-228 Soln.	Jul 88	205	109
3149	Selenium Spectro Soln.	Aug 94	104	51	4340	Plutonium-241 Soln.	May 86	205	109
3150	Silicon Spectro Soln.	Jul 94	104	51	4341	Neptunium-237	Jan 93	205	109
3151	Silver Spectro Soln.	Aug 94	104	51	4350B	River Sediment (Radioactivity)	Sep 81	205	113
3152a	Sodium Spectro Soln.	Dec 94	104	51	4351	Human Lung	Oct 82	205	113
3153a	Strontium Spectro Soln.	Feb 94	104	51	4352	Human Liver	Jun 82	205	113
3154	Sulfur Spectro Soln.	Mar 95	104	51	4353	Rocky Flats Soil #1	Dec 80	205	113
3155	Tantalum Spectro Soln.	Oct 93	104	51	4354	Lake Sediment (Radioactivity)	Feb 86	205	113
3156	Tellurium Spectro Soln.	Feb 94	104	51	4355	Peruvian Soil	Jun 82	205	113
3157a	Terbium Spectro Soln.	Dec 93	104	51	4357	Ocean Sediment (Radioactivity)	In Prep	205	113
3158	Thallium Spectro Soln.	Sep 93	104	51	4361B	Hydrogen-3 Soln.	Jan 81	205	109
3159	Thorium Spectro Soln.	Feb 94	104	51	4370C	Europium-152 Soln.	Mar 87	205	109
3160a	Thulium Spectro Soln.	Jan 94	104	51	4400N	Chromium-51 Soln.	FC	205	110
3161	Tin Spectro Soln.	May 94	104	51	4401T	Iodine-131 Soln.	FC	205	110
3162a	Titanium Spectro Soln.	Jul 94	104	51	4402C	Tin-113/Indium-113m Soln.	FC	205	110
3163	Tungsten Spectro Soln.	Dec 93	104	51	4403B	Strontium-85 Soln.	FC	205	110
3164	Uranium Spectro Soln.	Oct 93	104	51	4404Q	Thallium-201 Soln.	FC	205	110
3165	Vanadium Spectro Soln.	Jan 95	104	51	4405B	Gold-198 Soln.	FC	205	110

SRM/RM	Descriptor	Cert. Date	Section Code	Page	RM	Descriptor	Cert. Date	Section Code	Page
4406M	Phosphorus-32 Soln.	FC	205	110	8452	Polyethylene Piping, 10.2 cm	Jan 88	202	98
4407S	Iodine-125 Soln.	FC	205	110	8453	Poly Socket T Joint	Jan 88	202	98
4408D	Cobalt-57 Soln.	FC	205	110	8454	Poly Butt T Joint	Jan 88	202	98
4409D	Cobalt-57 Soln.	FC	205	110	8455	Pyrite Ore	Apr 91	111	81
4410HT	Technetium-99M Soln.	FC	205	110	8458	Artificial Flaw for Eddy Current NDF	Aug 91	303	128
4411B	Iron-59 Soln.	FC	205	110	8464	Aldrin (neat)	In Prep	109	69
4412S	Molybdenum-99/Technetium-99 Soln.	FC	205	110	8465	Dieldrin (neat)	In Prep	109	69
4414C	Iodine-123 Soln.	FC	205	110	8466	Y-HCH (Lindane) (neat)	Apr 92	109	69
4415R	Xenon-133 Gas	FC	205	110	8467	4,4'-DDE (neat)	Apr 92	109	69
4416O	Gallium-67 Soln.	FC	205	110	8468	Heptachlor (neat)	In Prep	109	69
4417N	Indium-111 Soln.	FC	205	110	8469	Pesticide, 4,4'-DDT (neat)	Apr 92	109	69
4418L	Mercury-203 Soln.	FC	205	110	8486	Portland Cement Clinker	May 89	113	89
4419C	Ytterbium-169 Soln.	FC	205	110	8487	Portland Cement Clinker	May 89	113	89
4420B	Lead-203 Soln.	FC	205	110	8488	Portland Cement Clinker	May 89	113	89
4421L	Gold-195 Soln.	FC	205	110	8491	Sugar Cane Bagasse	In Prep	110	78
4424	Sulfur-35 Soln.	FC	205	110	8492	Eastern Cottonwood	In Prep	110	78
4425A	Samarium-153 Soln.	FC	205	110	8493	Pinus Radiata	In Prep	110	78
4426A	Strontium-89 Soln.	FC	205	110	8494	Wheat Straw	In Prep	110	78
4427A	Yttrium-90 Soln.	FC	205	110	8495	Northern Softwood	N/A	209	122
4904NG	Americium-241	Apr 87	205	111	8496	Eucalyptus Hardwood	N/A	209	122
4904SG	Americium-241	Apr 87	205	111	8501	Catalyst Package IIIIE	Jul 91	114	91
4906C	Plutonium-238	Nov 87	205	111	8505	Vanadium in Crude Oil	Oct 83	108	66
4906HC	Plutonium-238	Nov 87	205	111	8506	Transformer Oil	Mar 92	108	67
4915E	Cobalt-60 Soln.	Feb 84	205	109	8507	Mineral Oil	Mar 92	108	67
4919G	Strontium-90 Soln.	May 88	205	109	8532	Diesel Fuel Oil	N/A	108	67
4926D	Hydrogen-3 Water Soln.	Aug 89	205	109	8535	VSMOW-Water	Oct 92	104	55
4927E	Hydrogen-3 Soln.	Jan 89	205	109	8536	GISP-Water	Oct 92	104	55
4929D	Iron-55 Soln.	Feb 86	205	109	8537	SLAP-Water	Oct 92	104	55
4943	Chlorine-36 (Beta) Soln.	Dec 84	205	109	8538	NBS30-Biotite	Jun 92	104	55
4947C	Hydrogen-3 Toluene Soln.	May 87	205	109	8539	NBS22-Oil	Jun 92	104	55
4949C	Iodine-129 Soln.	Feb 82	205	109	8540	PEFI-Polyethylene Foil	Jun 92	104	55
4950E	Radium-226 Soln.	May 84	205	109	8541	USGS24-Graphite	Jun 92	104	55
4952C	Radium-226 Blank Soln.	Jan 92	205	109	8542	Sucrose ANU-Sucrose	Jun 92	104	55
4965	Radium-226 Soln.	Jan 92	205	109	8543	NBS18-Carbonatite	Jun 92	104	55
4966	Radium-226 Soln.	Jan 92	205	109	8544	NBS19-Limestone	Jun 92	104	55
4967	Radium-226 Soln.	Jan 92	205	109	8545	LSVEC-Li Carbonate	Jun 92	104	55
4968	Radium-226	Aug 94	205	112	8546	NBS28-Silica Sand	Jun 92	104	55
4990C	Oxalic Acid (C-14 Dating)	Jul 83	205	111	8547	IAEAN1-Ammonium Sulfate	Feb 93	104	55
8050-8067	RCM Fine Gold	In Prep	104	55	8548	IAEAN2-Ammonium Sulfate	Feb 93	104	55
8068-8082	RCM Gold Bullion	In Prep	104	54	8549	IAEAN3-Potassium Nitrate	Feb 93	104	55
8101a	Auto. Computer Time Svc.	Aug 93	207	118	8550	USGS 25-Ammonium Sulfate	Feb 93	104	55
8153-8173	RCM Fine Silver	In Prep	104	54	8551	USGS 26-Ammonium Sulfate	Feb 93	104	55
8384	TBBS (powder)	Oct 92	202	98	8552	NSVEC-Gaseous Nitrogen	Feb 93	104	55
8406	Tennessee River Sediment	Jun 90	111	84	8553	Soufre De Lacq-Element-Sulf.	Jun 92	104	55
8407	Tennessee River Sediment	Jun 90	106	84	8554	NZ1-Silver Sulfide	Jun 92	104	55
8411	Mixed Asbestos Research Filter	Nov 88	105	60	8555	NZ2-Silver Sulfide	Jun 92	104	55
8412	Corn Stalk (Zea Mays)	Sep 93	110	77	8556	NBS123-Sphalerite	Jun 92	104	55
8413	Corn Kernel (Zea Mays)	Sep 93	110	77	8557	NBS127-Barium Sulfate	Jun 92	104	55
8414	Bovine Muscle Powder (Beef)	Sep 93	110	76	8558	USGS32-Potassium Nitrate	Feb 93	104	55
8415	Whole Egg Powder	Sep 93	110	76	8570	LGCGM Calcined Kaolin (Sur. Area)	Sep 94	301	126
8416	Micro. Cellulose	Sep 93	110	76	8571	LGCGM Alumina (Sur. Area)	Sep 94	301	126
8418	Wheat Gluten	Sep 93	110	76	8572	LGCGM Silica (Sur. Area)	Sep 94	301	126
8420	Iron Electrolytic	May 84	203/206	103/114	8590	High Sulfur Gas Oil Feed	N/A	114	90
8421	Iron Electrolytic	May 84	203/206	103/114	8600	Chinese Copper Ore	Jun 92	111	79
8423	Sintered Tungsten	May 84	203/206	103/114	8601	Chinese Copper Ore	Jun 92	111	79
8424	Graphite	May 84	203	103	8602	Chinese Lead Ore	Jun 92	111	79
8425	Graphite	May 84	203	103	8603	Chinese Lead Ore	Jun 92	111	79
8426	Graphite	May 84	203	103	8604	Chinese Zinc Ore	Jun 92	111	79
8432	Corn Starch	Sep 93	110	76	8605	Chinese Molyb. Ore	Jun 92	111	79
8433	Corn Bran	Sep 93	110	76	8606	Chinese Molyb. Ore	Jun 92	111	79
8435	Whole Milk Powder	Sep 93	110	76	8607	Chinese Tungsten Ore	Jun 92	111	79
8436	Durum Wheat Flour	Sep 93	110	76	8608	Chinese Tungsten Ore	Jun 92	111	79
8437	Hard Red Spring Wheat Flour	Sep 93	110	76	8754	ICTAC Polystyrene DTA	N/A	203	100
8438	Soft Winter Wheat Flour	Sep 93	110	76	8757	ICTAC Set DTA	In Prep	203	100
8439	Dietary Fiber	In Prep	110	76	8758	ICTAC Set DTA	In Prep	203	100
8442	LC Selectivity	Mar 90	109	69	8759	ICTAC Set DTA	N/A	203	100
8443	GC/MS System Performance	Aug 84	109	69	8760	ICTAC Set DTA	N/A	203	100
8444	Cotinine	Feb 89	105	58	8761	ICTAC Thermogravimetry	In Prep	203	100
8448	Drugs of Abuse in Hair	Mar 92	105	58					
8449	Drugs of Abuse in Hair	Feb 92	105	58					
8450	Polyethylene Piping, 1.3 cm	Jan 88	202	98					
8451	Polyethylene Piping, 4.8 cm	Jan 88	202	98					

N/A-Certificate does not exist.

FC-New certificate is issued with each new batch prepared.

In Prep-New or Renewal SRM being prepared.

Numerical MSDS Index

The following is a listing of Material Safety Data Sheets (MSDSs) for compounds that have been determined to be hazardous by the National Institute of Standards and Technology. Under current OSHA regulations, there is no expiration date associated with a MSDS. Materials not considered to require an MSDS, fall into one of the following categories:

1. The SRM is an article, as the word is defined in paragraph (c) of section 19.10.1200 of the title 29 of the Code of Federal Regulations, which does not release or otherwise result in exposure to a hazardous chemical, under normal conditions and use.
2. The SRM has been determined to be non-hazardous by the National Institute of Standards and Technology under paragraph (d) of section 19.10.1200 title 29 of the Code of Federal Regulations. The SRM will not release or otherwise result in exposure to a hazardous chemical under normal conditions of use.
3. The SRM is a pesticide or hazardous waste labeled according to regulations issued by the Environmental Protection Agency.
4. The SRM is a food, food additive, drug or clinical material labeled according to regulations issued by the Food and Drug Administration.
5. The SRM is a wine labeled according to regulations issued by the Bureau of Alcohol, Tobacco and Firearms.
6. The SRM is a tobacco product, wood or wood product which is exempted by paragraph (b)(5)(ii) and (iii) of section 19.10.1200 of title 29 of the Code of Federal Regulations from the provisions of that section.
7. The SRM was obsoleted before MSDS regulations came into effect.

Additional information about MSDSs can be obtained by contacting the SRM MSDS Coordinator at:

Telephone: (301) 975-6439

Fax: (301) 926-4751

E-Mail: SRMMSDS@enh.nist.gov

SRM	Descriptor	MSDS Date	Page
27f	Iron Ore, Sibley	Sep 94	80
39i	Benzoic Acid (Combustion Cal.)	Mar 92	99
40h	Sodium Oxalate (Reductometric)	May 90	49
58a	Ferrosilicon (73% Si)	Nov 93	36
59a	Ferrosilicon	Nov 93	36
76a	Burnt Refractory (Al2O3-40%)	Sep 94	83
77a	Burnt Refractory (Al2O3-60%)	Sep 94	83
78a	Burnt Refractory (Al2O3-70%)	Sep 94	83
81a	Glass Sand	Feb 88	83/86
83d	Arsenic Trioxide (Reductometric)	Dec 91	49
84j	Potassium Hydrogen Phthalate	Mar 92	49
114p	Portland Cement	Apr 94	125
127b	Solder, 40Sn-60Pb	Feb 94	43
136e	Potassium Dichromate (oxidimetric)	May 93	49
141c	Acetanilide	Sep 91	49
142	Anisic Acid	May 80	49
148	Nicotine Acid	Jan 87	49
165a	Glass Sand (Low Iron)	Sep 94	83/86
181	Lithium Ore (Spodumene)	Feb 93	79
182	Lithium Ore (Petalite)	Feb 93	79
183	Lithium Ore (Lepidolite)	Feb 93	79
185g	Potassium Hydrogen Phthalate, pH	Mar 92	95
187c	Sodium Tetraborate (Borax), pH	Oct 88	95
193	Potassium Nitrate	Sep 85	78
194	Ammonium Dihydrogen Phosphate	Sep 86	78
198	Silica Brick	May 94	83
199	Silica Brick	May 94	83
276b	Tungsten Carbide	Oct 83	85
350a	Benzoic Acid	Mar 92	49
371h	Sulfur (Rubber Compound)	Feb 93	98
372i	Stearic Acid (Rubber Compound)	Nov 93	98
383a	Mercaptobenzothiazole	Dec 78	98
640b	Line Position, Silicon (XRD)	May 92	121

SRM	Descriptor	MSDS Date	Page
659	Silicon Nitride, Particle Size	Apr 92	125
660	Line Profile, Lab6 (XRD)	Nov 92	121
671	Nickel Oxide 1	Dec 91	45
672	Nickel Oxide 2	Dec 91	45
673	Nickel Oxide 3	Dec 91	45
674a	Quant. Analysis, Set (XRD)	Oct 93	121
675	Line Position, Mica (XRD)	Jan 93	121
676	Quantitative Analysis, Alumina (XRD)	Nov 92	121
699	Alumina (Reduction Grade)	Nov 93	81
742	Alumina (Reference Point)	Jul 92	101
869	LC Column Selectivity	May 90	69
915a	Calcium Carbonate (Clinical)	Dec 91	56
928	Lead Nitrate (Clinical)	Mar 89	56
934	Clinical Thermometer	Mar 93	102
935a	Potassium Dichromate, UV Absorbance	Sep 94	104
951	Boric Acid, Assay and Isotopic	Apr 92	49/53
952	Boric Acid 95% enr. 10B	Apr 92	53
977	Bromine (Isotopic)	Oct 94	53
979	Chromium (Isotopic)	Dec 85	53
980	Magnesium (Isotopic)	Dec 85	53
981	Natural Lead (Isotopic)	Jan 92	53
982	Equal Atom Lead (Isotopic)	Jan 92	53
983	Radiogenic Lead (Isotopic)	Jan 92	53
984	Rubidium Assay (Isotopic)	Dec 85	53
986	Nickel (Isotopic)	Oct 94	53
987	Strontium Assay and Isotopic	Aug 94	49/53
989	Rhenium Assay (Isotopic)	Apr 94	53
991	Lead-206 Spike Assay and Isotopic	Oct 94	53
994	Gallium (Isotopic)	Sep 79	53
997	Thallium (Isotopic)	Oct 94	53
1007b	Plastic, (Smoke Density)	Sep 94	130
1051b	Barium (Metallo-Organic)	Feb 81	90
1052b	Vanadium (Metallo-Organic)	Jul 80	90

SRM	Descriptor	MSDS		SRM	Descriptor	MSDS	
		Date	Page			Date	Page
1053a	Cadmium (Metallo-Organic)	May 81	90	1683b	NO/N2, 50 µmol/mol	Dec 90	64
1057b	Tin (Metallo-Organic)	May 81	90	1684b	NO/N2, 100 µmol/mol	Sep 94	64
1059c	Lead (Metallo-Organic)	Jun 84	90	1685b	NO/N2, 250 µmol/mol	Dec 90	64
1060a	Lithium (Metallo-Organic)	Sep 86	90	1686b	NO/N2, 500 µmol/mol	Dec 90	64
1065b	Nickel (Metallo-Organic)	Feb 83	90	1687b	NO/N2, 1000 µmol/mol	Dec 90	64
1066a	Silicon (Metallo-Organic)	May 81	90	1693a	SO2/N2, 50 µmol/mol	Sep 94	65
1069b	Sodium (Metallo-Organic)	Aug 85	90	1694a	SO2/N2, 100 µmol/mol	Sep 94	65
1073b	Zinc (Metallo-Organic)	Jun 84	90	1696a	SO2/N2, 3500 µmol/mol	Sep 94	65
1075a	Aluminum (Metallo-Organic)	Feb 81	90	1700a	CO2/N2, 10 mol (Blood Gas) %	Sep 94	63
1077a	Silver (Metallo-Organic)	Feb 83	90	1701a	CO2-5%, O2-12 mol (Blood Gas) %/N2	Sep 94	63
1079b	Iron (Metallo-Organic)	Apr 85	90	1702a	CO2-5%, O2-20 mol (Blood Gas) %/N2	Sep 94	63
1080a	Copper (Metallo-Organics)	Feb 83	90	1703a	CO2-10%, O2-7 mol (Blood Gas) %/N2	Sep 94	63
1083	Wear Metals (Base Oil)	Mar 92	91	1800	Organic Compounds/N2	Feb 94	65
1084a	Wear Metals	Mar 92	91	1804a	Tox. Organic Compounds/N2	Oct 92	65
1085a	Wear Metals	Mar 92	91	1811	Aromatic Organics/N2	Apr 93	63
1129	Solder 63Sn-37Pb	Dec 93	43	1812	Aromatic Organics/N2	Apr 93	63
1131	Solder 60Pb-40Sn	Feb 94	43	1815a	n-Heptane (Fuel Rating)	May 93	67
1450b	Fibrous Glass Board	Apr 92	103	1816a	Isooctane (Fuel Rating)	Jan 93	67
1491	Arom. Hydro/Hexane Toluene	Aug 89	69	1817c	Catalyst Package IIID	Mar 90	91
1492	Chlor. Pesticides/Hexane	Sep 89	69	1818a	Chlorine in Lub. Base Oil	Apr 94	90
1493	PCB Congeners	Dec 94	69	1819a	Sulfur in Lub. Base Oil	Apr 94	90
1514	Thermal Analysis Purity Set (DSC)	May 92	100	1828a	Ethanol-Water Soln.	Aug 93	57
1543	GC/MS and LS System Performance	Mar 92	69	1829	Alcohols in Ref. Fuels	Aug 93	66
1579	Powdered Lead Base Paint	Jan 92	60	1837	Methanol, Butanol (Fossil Fuel)	Jun 93	66
1581	PCBs in Oil	Dec 91	69	1838	Ethanol (Fossil Fuel)	May 93	66
1583	Chlor. Pesticide in Isooctane	Feb 93	69	1839	Methanol (Fossil Fuel)	Jun 93	66
1584	Phenols in Methanol	Mar 91	69	1866a	Common Commercial Asbestos	Jan 94	60
1585	Chlorinated Biphenyls	Feb 93	69	1867	Uncommon Commercial Asbestos	Aug 93	60
1586	Isotope Label Pollutants	Jun 93	69	1879	Respirable Cristobalite	Mar 91	60
1587	Nitro PAH in Methanol	Sep 93	69	1880	Portland Cement, Black	Jan 92	88
1597	Complex PAH Mix	Feb 94	69	1881	Portland Cement, White	Apr 91	88
1614	Dioxin in Isooctane	Aug 93	69	1882	Portland Cement, Orange	Jan 91	88
1616a	Sulfur in Kerosene	Mar 88	67	1883	Portland Cement, Silver	Apr 91	88
1617a	Sulfur in Kerosene	Mar 88	67	1884	Portland Cement, Ivory	Apr 91	88
1618	Vanadium & Nickel in Fuel Oil	Apr 91	66	1885	Portland Cement, Turquoise	Apr 91	88
1619a	Sulfur in Residual Fuel Oil	Apr 91	67	1886	Portland Cement, Cranberry	Apr 91	88
1620b	Sulfur in Residual Fuel Oil	Sep 90	67	1887	Portland Cement, Brown	Apr 91	88
1621d	Sulfur in Residual Fuel Oil	Aug 93	67	1888	Portland Cement, Purple	Apr 91	88
1622d	Sulfur in Residual Fuel Oil	Nov 93	67	1889	Portland Cement, Gray	Apr 91	88
1623b	Sulfur in Residual Fuel Oil	Sep 94	67	1920	IR Reflectance	Jun 92	107
1624b	Sulfur in Distillate Fuel Oil	May 90	67	1941a	Organics in Marine Sediment	Aug 92	69
1625	SO2 Permeation Tube-10 cm	Dec 91	65	1970	Succinonitrile (Fixed Point)	Nov 92	101
1626	SO2 Permeation Tube-5 cm	Dec 91	65	1978	Zirconium Oxide (Particle Size)	Oct 93	125
1629a	NO2 Permeation Device 1cm	May 94	65	2034	Holmium Oxide Wavelength	Feb 92	106
1632b	Trace Elements in Coal (Bituminous)	Feb 93	68	2108	Chromium (III) Speciation	Jun 93	53
1633b	Trace Elements in Coal Fly Ash	Nov 85	68	2109	Chromium (VI) Speciation	Aug 92	53
1634c	Trace Elements in Fuel Oil	Jun 92	68	2141	Urea	Oct 94	49
1635	Trace Elements in Coal (Subbituminous)	Sep 94	68	2142	0-Bromobenzoic Acid	Aug 85	49
1639	Halocarbons (in methanol)	May 93	69	2143	p-Fluorobenzoic Acid	Mar 88	49
1641c	Mercury in Water	Dec 89	61	2144	m-Chlorobenzoic Acid	May 91	49
1643d	Trace Elements in Water	In Prep	61	2185	Pot. Hydrogen Phthalate	Mar 92	95
1647c	Priority Pollutant PAHs	Apr 93	69	2193	Calcium Carbonate	Dec 91	95
1658a	CH4/Air, 1 µmol/mol	Jan 91	64	2203	Potassium Fluoride (Ion-Selective)	May 82	96
1659a	CH4/Air, 10 µmol/mol	Jan 91	64	2220	Tin (Dif. Scan. Calor.)	Sep 94	100
1660a	CH4-C3H8/Air, 1 µmol/mol	Oct 93	64	2222	Biphenyl (Dif. Scan. Calor.)	Mar 93	100
1661a	SO2/N2, 500 µmol/mol	Aug 89	65	2225	Mercury (Dif. Scan. Calor.)	Mar 93	100
1662a	SO2/N2, 1000 µmol/mol	Aug 89	65	2260	Aromatic Hydrocarbons in Toluene	Dec 91	69
1663a	SO2/N2, 1500 µmol/mol	Aug 89	65	2261	Chlorinated Pesticides in Hexane	Feb 92	69
1664a	SO2/N2, 2500 µmol/mol	Aug 89	65	2286	Ethanol in Gasoline	Jan 95	66
1665b	C3H8/Air, 3 µmol/mol	Sep 89	64	2287	Ethanol in Gasoline	Jan 95	66
1666b	C3H8/Air, 10 µmol/mol	Sep 89	64	2288	t-Amyl Methyl Ether in Gas.	Jan 95	66
1667b	C3H8/Air, 50 µmol/mol	Sep 89	64	2289	t-Amyl Methyl Ether in Gas.	Jan 95	66
1668b	C3H8/Air, 100 µmol/mol	Sep 89	64	2290	Ethyl t-Butyl Ether in Gas.	Jan 95	66
1669b	C3H8/Air, 500 µmol/mol	Sep 89	64	2291	Ethyl t-Butyl Ether in Gas.	Jan 95	66
1674b	CO2/N2, mol 7%	Sep 94	63	2292	Methyl t-Butyl Ether in Gas.	Jan 95	66
1675b	CO2/N2, mol 14%	Sep 94	63	2293	Methyl t-Butyl Ether in Gas.	Jan 95	66
1677c	CO/N2, 10 µmol/mol	Jan 91	64	2389	Amino Acids in Hydrochloric Acid	Jan 94	56
1678c	CO/N2, 50 µmol/mol	Jan 91	64	2579	Lead Paint Film	Oct 92	60
1679c	CO/N2, 100 µmol/mol	Jan 91	64	2582	Powdered Paint, (Low Lead)	Jul 94	60
1680b	CO/N2, 500 µmol/mol	Jan 91	64	2607	CO2/N2O/Air, 340/0.3 µmol/mol	Nov 88	63
1681b	CO/N2, 1000 µmol/mol	Jan 91	64	2609	CO2/N2O/Air, 380/0.33 µmol/mol	Nov 88	63

SRM	Descriptor	MSDS Date	Page
2610	CO ₂ /N ₂ /Air, 380/0.33 μmol/mol	Nov 88	63
2612a	CO/Air, 10 μmol/mol	Jun 91	63
2613a	CO/Air, 20 μmol/mol	Jun 91	63
2614a	CO/Air, 45 μmol/mol	Jun 91	63
2619a	CO ₂ /N ₂ , 0.5 mol %	Jun 92	63
2620a	CO ₂ /N ₂ , 1.0 mol %	Jun 92	63
2621a	CO ₂ /N ₂ , 1.5 mol %	Jun 92	63
2622a	CO ₂ /N ₂ , 2.0 mol %	Jun 92	63
2623a	CO ₂ /N ₂ , 2.5 mol %	Jun 92	63
2624a	CO ₂ /N ₂ , 3.0 mol %	Jan 93	63
2625a	CO ₂ /N ₂ , 3.5 mol %	Jan 93	63
2626a	CO ₂ /N ₂ , 4.0 mol %	Jan 93	63
2627a	NO/N ₂ , 5 μmol/mol	Jan 91	64
2628a	NO/N ₂ , 10 μmol/mol	Jun 91	64
2629a	NO/N ₂ , 20 μmol/mol	Jun 91	64
2630	NO/N ₂ , 1500 μmol/mol	Jun 91	64
2631a	NO/N ₂ , 3,000 μmol/mol	Jun 91	64
2632a	CO ₂ /N ₂ , 300 μmol/mol	Jun 91	63
2635a	CO/N ₂ , 25 μmol/mol	Jan 89	64
2636a	CO/N ₂ , 250 μmol/mol	Jun 92	64
2637a	CO/N ₂ , 2500 μmol/mol	Jun 92	64
2638a	CO/N ₂ , 5000 μmol/mol	Jun 92	64
2639a	CO/N ₂ , 1 mol %	Jun 92	64
2640a	CO/N ₂ , 2 mol %	Dec 88	64
2641a	CO/N ₂ , 4 mol %	Dec 88	64
2642a	CO/N ₂ , 8 mol %	Sep 92	64
2643a	C ₃ H ₈ /N ₂ , 100 μmol/mol	Dec 90	65
2644a	C ₃ H ₈ /N ₂ , 250 μmol/mol	Dec 90	65
2645a	C ₃ H ₈ /N ₂ , 500 μmol/mol	Dec 90	65
2647a	C ₃ H ₈ /N ₂ , 2500 μmol/mol	Dec 90	65
2648a	C ₃ H ₈ /N ₂ 5000 μmol/mol	Nov 93	65
2649a	C ₃ H ₈ /N ₂ , 1 mol %	Dec 90	65
2650	C ₃ H ₈ /N ₂ , 2 mol %	Feb 93	65
2651	C ₃ H ₈ /N ₂ & O ₂ , 0.01/5 mol %	Aug 93	65
2652	C ₃ H ₈ /N ₂ & O ₂ , 0.01/10 mol %	Aug 93	65
2656	NO _x /Air, 2500 μmol/mol	Aug 93	64
2657a	O ₂ /N ₂ , 2 mol %	Jul 93	64
2658a	O ₂ /N ₂ , 10 mol %	Jul 93	64
2659a	O ₂ /N ₂ , 21 mol %	Jul 93	64
2660	NO _x /Air, 100 μmol/mol	Jul 93	64
2682a	Sulfur in Coal, 0.5%, (also Heat of Comb.)	Apr 91	67
2683a	Sulfur in Coal, 2%, (also Heat of Comb.)	Apr 91	67
2684a	Sulfur in Coal, 3%, (also Heat of Comb.)	Apr 91	67
2685a	Sulfur in Coal, 5%, (also Heat of Comb.)	Apr 91	67
2689	Coal Fly Ash	Nov 85	68
2690	Coal Fly Ash	Nov 85	68
2691	Coal Fly Ash	Nov 85	68
2692a	Sulfur in Coal, 1%	Jul 94	67
2712	Lead in Ref. Fuel	Nov 88	66
2713	Lead in Ref. Fuel	Nov 88	66
2714	Lead in Ref. Fuel	Nov 88	66
2715	Lead in Ref. Fuel	Nov 88	66
2717	Sulfur in Residual Fuel Oil	Feb 93	67
272a	Sulfur in Diesel Fuel Oil, 0.04%	Jun 93	67
2727	IM Gases, 3 Components	Feb 89	64
2728	IM Gases, 3 Components	Feb 89	64
2735	NO/N ₂ , 800 μmol/mol	Dec 90	64
2736	NO/N ₂ , 2000 μmol/mol	Dec 90	64
2740	CO/N ₂ , 10 mol %	Jan 91	64
2741	CO/N ₂ , 13 mol %	Jan 91	64
2764	C ₃ H ₈ /Air, 0.25 μmol/mol	Jan 94	64
3101a	Aluminum Spectro Soln.	May 93	50
3102a	Antimony Spectro Soln.	Jun 93	50
3103a	Arsenic Spectro Soln.	Jul 93	50
3104a	Barium Spectro Soln.	Sep 93	50
3105a	Beryllium Spectro Soln.	Jan 94	50
3106	Bismuth Spectro Soln.	May 88	50
3108	Cadmium Spectro Soln.	May 90	50
3109a	Calcium Spectro Soln.	May 93	50
3110	Cerium Spectro Soln.	Apr 89	50
3111a	Cesium Spectro Soln.	Jul 93	50

SRM	Descriptor	MSDS Date	Page
3112a	Chromium Spectro Soln.	May 93	50
3113	Cobalt Spectro Soln.	Mar 89	50
3114	Copper Spectro Soln.	May 90	50
3115a	Dysprosium Spectro Soln.	Mar 94	50
3116a	Erbium Spectro Soln.	Jan 94	50
3117a	Europium Spectro Soln.	Jan 93	50
3118a	Gadolinium Spectro Soln.	Jan 93	50
3119a	Gallium Spectro Soln.	Oct 93	50
3120	Germanium Spectro Soln.	Apr 89	50
3121	Gold Spectro Soln.	Sep 88	50
3122	Hafnium Spectro Soln.	Jan 94	50
3123a	Holmium Spectro Soln.	Feb 94	50
3124a	Indium Spectro Soln.	May 93	50
3126a	Iron Spectro Soln.	Feb 94	50
3127a	Lanthanum Spectro Soln.	May 93	50
3128	Lead Spectro Soln.	Sep 88	50
3129a	Lithium Spectro Soln.	May 93	50
3130a	Lutetium Spectro Soln.	Feb 94	50
3131a	Magnesium Spectro Soln.	May 93	50
3132	Manganese Spectro Soln.	Apr 89	50
3133	Mercury Spectro Soln.	Apr 89	50
3134	Molybdenum Spectro Soln.	May 90	50
3135a	Neodymium Spectro Soln.	May 93	50
3136	Nickel Spectro Soln.	Sep 88	50
3138	Palladium Spectro Soln.	Apr 89	50
3139a	Phosphorus Spectro Soln.	Jul 94	50
3140	Platinum Spectro Soln.	Apr 89	50
3141a	Potassium Spectro Soln.	May 93	50
3142a	Praseodymium Spectro Soln.	May 93	50
3143	Rhenium Spectro Soln.	Jul 88	50
3144	Rhodium Spectro Soln.	Jan 93	50
3145a	Rubidium Spectro Soln.	Jan 94	50
3147a	Samarium Spectro Soln.	Jan 94	51
3148a	Scandium Spectro Soln.	May 93	51
3149	Selenium Spectro Soln.	Apr 89	51
3151	Silver Spectro Soln.	Apr 89	51
3152a	Sodium Spectro Soln.	Sep 94	51
3153a	Strontium Spectro Soln.	May 93	51
3154	Sulfur Spectro Soln.	Feb 93	51
3155	Tantalum Spectro Soln.	Mar 89	51
3156	Tellurium Spectro Soln.	Mar 90	51
3157a	Terbium Spectro Soln.	Feb 94	51
3158	Thallium Spectro Soln.	Feb 89	51
3159	Thorium Spectro Soln.	Jan 89	51
3160a	Thulium Spectro Soln.	Mar 94	51
3161	Tin Spectro Soln.	May 88	51
3162a	Titanium Spectro Soln.	Jan 93	51
3163	Tungsten Spectro Soln.	Nov 88	51
3164	Uranium Spectro Soln.	Feb 90	51
3165	Vanadium Spectro Soln.	Feb 90	51
3166a	Ytterbium Spectro Soln.	Feb 94	51
3167a	Yttrium Spectro Soln.	Jul 93	51
3168a	Zinc Spectro Soln.	Oct 93	51
3169	Zirconium Spectro Soln.	Oct 88	51
3171a	Multielement Mix A1 Soln.	May 93	51
3172a	Multielement Mix B1 Soln.	Jan 93	52
3179	Multielement Mixes I, II, III	Nov 93	52
3183	Fluoride Anion Soln.	Feb 93	53
8443	GC/MS System Performance	Mar 92	69
8466	Y-HCH (Lindane) (neat)	May 92	69
8467	4,4'-DDE (neat)	May 92	69
8469	Pesticide, 4,4'-DDT (neat)	May 92	69
8505	Vanadium in Crude Oil	Jan 93	66
8506	Transformer Oil	Mar 92	67
8507	Mineral Oil	Mar 92	67
8570	LGCGM Calcined Kaolin (Sur. Area)	Apr 85	126
8571	LGCGM Alumina (Sur. Area)	May 92	126
8572	LGCGM Silica (Sur. Area)	May 85	126
8590	High Sulfur Gas Oil Feed	Dec 91	90
8759	ICTAC Set DTA	Aug 93	100
8760	ICTAC Set DTA	Aug 93	100



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